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A SYSTEM

OF

MIDWIFERY.

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A SYSTEM OF
MIDWIFERY

INCLUDING THE DISEASES OF PREGNANCY AND THE PUERPERAL STATE

BY

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OBSTETRICAL AND GYNÆCOLOGICAL SOCIETY
OF BERLIN; ETC.

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PREFACE TO THE FOURTH EDITION.

In endeavouring to bring the present Edition into harmony with the most recent developments of the subject, the Author has found it necessary, among other changes, entirely to re-cast the chapters on Physiology. In this he has received much valuable advice and assistance from his colleague, Professor M'Kendrick, F.R.S., including the use of a number of new illustrations, which he desires gratefully to acknowledge.

He is also under much obligation to Mr. W. B. Leishman, M.B., of the Army Medical Staff, in passing the volumes through the press.

11 Woodside Crescent, Glasgow,
August, 1888.

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CHAPTER I.

INTRODUCTORY.

History of Midwifery.—Hippocratic Era.—Arabian School.—Early History of Midwifery in Europe.—Mauriceau.—English Midwifery.—Objections to the Practice of Midwifery considered.—Comparative Anatomy of the Pelvis.—Obstetrical Functions of the Pelvis.—The Pelvis in the Primates: in the various Races.—The Erect Posture the Main Cause of Comparative Difficulty in Human Species.—The Human Pelvis a Curved Canal.—Separation of Pelvic Articulations during Labour.—Midwifery Defined.

History of Midwifery.—This, to the student, is a subject not only interesting, but in no small degree instructive. To trace from their earliest development, whether in the crude ideas of ancient times or in the hasty generalizations of an epoch not far distant from our own, the growth and maturity of theories which we now believe to be in accordance with the truth, is indeed in itself an attractive pursuit; and the student has his reward in the thorough mastery he thus obtains over details, which can scarcely be effected by the mere dogmatism of ordinary teaching.

For various and evident reasons, however, the history of the obstetric art cannot be embraced fittingly within the limits which must be fixed for matter purely introductory to the study of a great practical subject. Not even in outline, then, will a consecutive history of midwifery be attempted; but, as reference will in the sequel be not unfrequently made to the doctrines and practice of the past, a few sentences may here be devoted to the consideration of the midwifery of certain epochs, in view of the influence which these may be supposed to exercise on the practice of the present day.

Hippocratic Era.—From the earliest records, more or less authentic, which seem to throw light upon the subject, it would appear that the practice of midwifery was, in the first ages, entirely in the hands of women. If we may judge, however, from the fact that a law was passed in Athens, at a very early period, by which women were absolutely prohibited from practising physic in any of its branches, we are entitled to assume that the art had not in the main prospered in their hands. It is in the Hippocratic writings that we find the first trace of a profound intellect and a truly scientific mind being applied to the observation of the phenomena of parturition. The works, indeed, on this subject, which are attributed to Hippocrates, are, for the most part, passed over as unauthentic by modern critics : but there can at least be no doubt that they were written before Aristotle, at the latest, we may assume, about 400 B.C. The head, according to the former authority, is the only natural presentation, and when the child either lies across, or presents by the feet, the woman cannot be delivered. Observe the effect of this aphorism. The head being thus assumed to be the only presentation in which the natural forces could effect delivery, it follows, as the natural corollary of this proposition, that one of the chief aims of operative midwifery must be to convert breech and footling, as well as transverse presentations, into presentations of the head. The contemplation of such a state of practice is too horrible to dwell upon. His graphic illustration of the olive in the neck of the oil jar is familiar to all, and demonstrates to perfection that it can, in its long diameter, be easily passed through ; "but," he adds, "if the long diameter of this oval body be thrown across, either the bottle will break or the olive will be crushed." It is strange, indeed almost incredible, that, having recognised the form of the fœtus while in the womb, as this simile clearly shows, he should have failed to perceive that an oval body, be it olive or fœtus, may pass by either end of its long diameter. Overlooking this fact, he established a rule of practice, which obtained in after ages, as there is every reason to believe, for a period little short of 2,000 years, at what expense of maternal and fœtal life it is impossible to compute. From this early period we must also date the operation of craniotomy, for the performance of which quite intelligible rules are given.

Celsus.—This error of Hippocrates was corrected by Aristotle and subsequently by Celsus ; but it is to the latter that the credit in this matter is usually ascribed by the commentators, as his words are clear and free from ambiguity. This is manifest from the following sentence alone, extracted from the instructions given by him for the management of transverse cases :—"Medici vero propositum est, ut eum manu dirigat, vel in caput, *vel etiam in pedes*, si forte aliter compositus est."

Ætius.—Some four or five hundred years later, a careful compilation of all that had been written up to that time on the subject of midwifery was made by Ætius. Among the untoward circumstances detailed as causes of difficult labour, he mentions a narrow pelvis, the presence of polypi, and obliquity in the position of the womb. He states, further, that an anchylosis of the *ossa pubis* at their point of junction is a fertile cause of difficult labour, by preventing the separation which he supposes would otherwise occur; and that distention of the rectum or bladder may constitute a mechanical impediment to delivery. He observes also, that difficult labour is due as well to a faulty condition of the child as of the maternal parts. If the child, or any of its parts, were unduly large, labour was presumed to be impeded by the fact that the motions and leaping of the child (supposed, even in comparatively modern times, to contribute greatly to its delivery), were thereby interfered with. Many other points of interest and of practical importance are referred to by him, one or two of which may be noticed. We have here, for example, in a chapter, "De Fœtûs Extractione ac Exsectione," which he takes from Philumenus, the first indication of the speculum vaginæ, in an instrument which he recommends for the purpose of separating the external parts, in order to bring the cause of obstruction into view. We have also a perfect description of the crotchet (*uncinus attractorius*); and in his description of a method of delivery by the application of two crotchets—one to each side of the head—we cannot fail to observe that the mechanical principle of the midwifery forceps was not only then adopted in practice, but was thoroughly understood by the author, and brought him very near to the discovery of the forceps of modern times. And, finally, we have here the operation of turning recommended in cases of difficult cranial presentation, in terms which place it beyond a doubt that the procedure indicated is in all respects identical with what of late years has been introduced in similar cases, as a novelty and an improvement in modern practice. The credit of the discovery and demonstration of the Fallopian tubes was claimed by Galen, but there is no doubt that they were described at a still earlier period than the epoch now in question by Rufus Ephesius, who lived in the reign of Trajan (*circa* A.D. 110). The last writer on this subject of the old Greek school was Paulus Ægineta, to whose works little originality can be attributed.

Arabian School.—The favour in which literature and the sciences were held by the Arabs evidently exercised a most beneficial influence on the development of the art. The name of Rhazes, a physician of Bagdad towards the end of the ninth century, is associated with the discovery of the fillet. About a hundred years later a very remarkable and voluminous series of works on midwifery and allied subjects was given to the world by Avicenna, a physician of Ispahan. His works consist for the most part in a confirmation of the leading views of the Greek school, and as they enjoyed an extraordinary popularity in Europe, as well as in Asia, it was by this channel mainly that the errors of the ancients were diffused throughout the world. The fundamental error of Hippocrates he adopts in a modified degree. All presentations, he says, except the head, are preternatural: the head ought, therefore, to be brought, in all such cases, into the natural position, but, should this be impracticable, we may deliver by the feet. He recommends in certain cases the use of the fillet, which, when used for extraction, is to be fixed over the head; and, should this fail, *the forceps* is to be applied to the head and extraction then attempted, while, as a last resource only, are the perforator and crotchet to be employed.[1] A reference to this passage makes it perfectly clear that the instrument alluded to is essentially the midwifery forceps; while the fact that the author nowhere describes the instrument as a novelty warrants us in the belief that, about the tenth century, or possibly at an earlier period, the use of [this important instrument was familiar to the Arabian physicians. In the works of a later writer, of the eleventh or twelfth century,[2] the forceps then used in midwifery is described and delineated. It is represented under two different forms, the *misdach* and the *almisdach*. In the Arab original in the Bodleian Library at Oxford, to which Smellie refers in his learned introduction, the former of these is described as straight and the latter as curved, but in the Latin version both are described as circular and full of teeth.

From this period, until the invention of printing in the middle of the fifteenth century diffused a knowledge of the writings of the ancients throughout the civilized world, our art seems to have made but little progress. Indeed, we may even say with truth, that after the decline of learning in the East, the art of midwifery, as practised in Europe, was far inferior to what obtained among the Arabians and even among the later Grecian writers. This we may easily understand if we reflect that Hippocrates was the text-book in the hands of all, and that his errors continued to influence the practice of midwifery until the dawn of science, after the dark ages of our art, dissipated in some measure the mists of ignorance and superstition.

Early History of Midwifery in Europe.—In 1518, Dr. Linacre, physician to Henry VIII., obtained, through his interest with Cardinal Wolsey, letters-patent constituting a corporate body of regular physicians in London. This foundation of the Royal College of Physicians of

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[1] See the chapter, "De regimine ejus, cujus partus fit difficilis causâ magnitudinis fœtûs."

[2] Albucasis or Alsaharavius.

England marks the period at which midwifery, for the first time in this country, was brought within the domain of science. It must be confessed, however, that the earliest efforts of English authors contributed but little to the advancement of the art, as founded upon true scientific principles. The first English work on the subject was a translation of Eucharius Rhodion, by Dr. Raynalde, under the title of "The Byrthe of Mankynde."[1] That this work was held in no little repute on the Continent is evident from the fact that it had been translated from the original High Dutch, not only into Latin, but also into Dutch, French, Spanish, and other languages. And yet, when we examine it critically, we find that, except as a literary curiosity, it scarcely merits our attention. Not only does the authority endorse the famous blunder of Hippocrates, by saying that we should turn the child to the natural position even when the feet present, but he boldly promulgates another error when he says that when the child presents in the natural way by the head, the face and foreparts of the fœtus are towards the foreparts of the mother. In most other respects his views are but copies from the ancient writers. The same remark may be made with reference to the productions of his contemporaries, as we find doctrines which are essentially the same promulgated in the collection of monographs, memoirs, and reproductions from ancient and modern sources, by Israel Spachius, known as the "Gynæciorum Commentaria,"[2] a collection familiar to all who have investigated this subject. A very superficial study of this compilation will suffice to show that even the more flagrant errors of the ancients were still systematically taught; and therefore are we bound to conclude that the Hippocratic aphorism of turning by the head in breech presentation had, up to this period, been all but universally adopted in European practice, even although that error had been to a great extent corrected by the later Greek and the Arabian writers. It is not, then, too much to assert, as we have done, that the blunder of Hippocrates, so frequently alluded to, was the rule of practice for little less than 2,000 years after his death.

Paré.—In this collection, however, there is one work which we must mention with respect—that of the illustrious Ambroise Paré—of whom Smellie says no more than is his due when he terms him "the famous restorer and improver of midwifery." The revival of anatomical study under Vesalius, and the numerous dissections which had been made of pregnant women by him and by his follower Columbus, had already corrected many of the anatomical and physiological errors, which, being time-honoured, were therefore considered to be respectable, and were generally admitted to be true. The belief in these doctrines being thus sapped by the logic of facts, the whole rotten superstructure began to crumble away, and from this epoch modern midwifery may be said to have had its origin. It required a mind of no ordinary power and energy to be the pioneer in this new path; but it requires no critical analysis of the work of Paré to show that the great surgeon was a great master, and that scientific Midwifery as well as Surgery had at last found a fitting modern exponent. Paré advises turning by the feet in difficult cranial presentations; but if this cannot be done, he recommends craniotomy, or delivering by the crotchet,—which instrument he directs us to fix, by the method of Ætius, in the orbit or mouth, or below the chin. He frankly confesses, that although he has carefully studied the position of the fœtus in utero, he has been unable to come to a satisfactory conclusion as to what is to be considered the normal position; while, as regards the causes of difficult labour, he dilates at some length, and on the whole with considerable accuracy. After pointing out with great clearness the serious nature of the impediment caused by cicatrices, the result of former midwifery accidents, he enumerates the various positions of the fœtus which interfere with or prevent delivery, and concludes by noting the bad effects of uterine inertia, and of the premature escape of the waters.

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[1] London, 1565.

[2] Basel, 1586.

Mauriceau.—At this period, the Parisian school was undoubtedly the first in the world; and, as all the leading surgeons there practised midwifery, the practice as well as the theory of obstetrics became rapidly developed. Guillemeau, surgeon to the French king, and a pupil of Ambroise Paré, further developed the theories of his master; but the book which seems to have exercised the greatest influence was the remarkable one of Mauriceau, "Sur les Maladies des Femmes grosses, et de ceux qui sont accouchées." This author gives by far the best account which, up to his day, had appeared of the phenomena of labour as observed by the accoucheur. He criticises with some asperity the views of Columbus, which, however, we find to be, at least as regards the position of the child in the womb, infinitely more correct than his own. The following are his conclusions on this point:—Up to the seventh or eighth month, the child is situated in the centre of the womb, the head being towards the fundus and the face looking directly forwards. About this period an important change takes place in its position, which, if it happens sooner, is attended with danger. The weight of the head and upper part of the infant having now become relatively greater, it causes the child to turn forwards (*faire la culbute en devant*), so that the face is now turned directly backwards to the promontory of the sacrum. This doctrine is simply an amplification of the views of Hippocrates on this point; and it must be admitted, even in the present day, that the greater relative frequency of breech and irregular presentations in cases of premature delivery, lends some apparent confirmation to the idea. He repudiates the view formerly entertained, that the child, by its own instinctive or automatic movements, aided in any way in effecting its expulsion, and recognised not only the contractility of the uterine tissue, but also the supplementary expulsive force which is derived from the muscles of the abdominal walls, these acting, as he shows, with greater effect upon the rounded back and nates of the child than they could upon the head, did the head present. Mauriceau seems also to have some indistinct and inaccurate idea of the rotation which occurs in the pelvis; for, after stating that, in footling cases, it is necessary that the face in its descent should look backwards, he gives directions for turning the child during its descent, *unless this has already taken place*, so as to make the heels look directly forward.

Any one who may wish to pursue this subject further will find ample and most interesting material in the works of Peu, Dionis, Deventer, La Motte, Puzos, Roederer, Levret, and others. In many of these, new errors are developed, such, for example, as the undue importance given to uterine obliquities by Deventer and his followers, who supposed them to be a frequent cause of tardy labour. The re-discovery of the midwifery forceps by the Chamberlens, about the middle of the seventeenth century, marks another and most important epoch; but this will fall to be more particularly considered when we come to discuss the forceps and its uses.

The interesting subject of the mechanism of parturition was inaugurated about a century and a half ago by Sir Fielding Ould, of Dublin, and this, too, is another important era in the history of midwifery. To trace the successive steps, from the faint glimmering of the truth which perplexed the shrewdness of Ould, and baffled the astuteness of Smellie, to the full development of the modern theory as it was laid before the scientific world in the celebrated essay of Naegele, would lead us upon ground which for the present we must avoid. In the sequel, and at the proper place, such of the historical facts as are essential to the comprehension of this subject will be briefly noted.[1]

Objections to Practice of Midwifery.—It seems, on first sight, a paradox that the practice of midwifery should involve, in the human species, the supervision of a function which is purely physiological, and should be claimed by its professors as an important branch of the healing art. So difficult, indeed, has this problem been of solution, that many, from Rodericus á Castro downwards, have asserted that the practice of the art was derogatory to professional dignity, and an unnecessary interference with a natural process. "Obstetriciam artem nec exercui nec exercere volo," wrote one of these; and there is reason to believe that the words find an echo even now. We need scarcely pause to refute the former of the two objections. We presume we may hold it as proved that, from the very earliest times, women required and obtained assistance at the period of delivery. This assistance was afforded, as we have already seen, by persons of their own sex; and that there is a fitness in this no one will gainsay. If we may judge, however, from the Athenian laws, we may assume that the practice of obstetrics did not prosper in the hands of women; but it must be confessed that there is evidence enough in the works of Arsinoe and Cleopatra to prove that some of them, at least, were quite familiar with the doctrines and practice of their age. And it must be conceded further, in these days when women are knocking so loudly, and with such importunity, at the portals of professional recognition, that if the mantle of Mesdames La Chapelle and Boivin could be made to fall on the shoulders of their sisters of the present generation, female delicacy would be saved many a rude shock, and the cause of science would in no sense suffer. But what do they say who repudiate the general practice of the art? Women, they assert, should in their hour of need be attended by women, and only in the case of difficulty or danger should the male accoucheur be summoned. The answer to this simply is, that the assistance of the latter would, under such circumstances, be of no value whatever, as without a knowledge of the healthy or normal standard, which can only be attained by the constant observation of the natural process, ignorance, not skill, would be called upon to act. To the full as rational would it be to ask one to compute distance or space who had no knowledge of the standards of lineal measurement or capacity. Certainly, in the present day, men are required for the practice of midwifery, skilled in medicine and the allied sciences, and who do not think of their dignity, any more than of their ease and comfort, when their services are in this matter required.[1]

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[1] For a critical analysis of this subject, see an essay by the author "On the Mechanism of Parturition." London, 1864.

In regard to the other objection, we must, of course, admit that parturition is a physiological function. But, in the discharge of this function, there exist in the human species peculiar conditions which exercise, as compared with the lower animals, a special influence upon the progress and issue of labour. What these conditions are will be best understood by a reference to one or two points in comparative anatomy, which reveal certain analogies, the appreciation of which clears away many difficulties, and a knowledge of which is, in point of fact, almost essential to the student of midwifery.

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[1] It is a source of gratification to all obstetricians that in these days the last shreds of the old opprobrium which clung to the practice of midwifery have been finally removed by the Medical Act of 1886, in which Medicine, Surgery, and Midwifery are bracketed together as constituting at once the Trinity and the Unity of the Healing Art.

Comparative Anatomy of Pelvis.—At an early period of mammalian development, two rods or bars of cartilage may be observed passing, more or less obliquely, from the dorsal towards the ventral surface of the embryo near its caudal extremity.[1] The two parts are separated at their dorsal extremity, where they embrace the vertebral column; while in front, in most cases, they meet and form a *symphysis.* This is the primitive pelvis. As the process of development goes on, the cartilage of each side, widening to a great extent superiorly, ossifies from three centres, by the union of which the *os innominatum* is formed, the two lower segments—*ischium* and *pubis*—leaving a gap between them, the *obturator* or *thyroid* foramen. If we except the Cetacea and Sirenia, in which the pelvis is almost rudimentary, these characteristics are common to the whole mammalia. The innominate bones are firmly united above to the sacral vertebræ, and usually below to each other at the *symphysis;* and this union, firm as it is, is greatly strengthened by a double ligamentous union of considerable strength between the sacral and caudal vertebræ on the one hand, and the ischia on the other. This is familiar to anatomists as the greater and lesser sacro-sciatic ligaments, which are sometimes replaced by bone—as in the sloth.

The mammalian pelvis, then, by the union of the two innominate bones and the sacrum, forms, with some exceptions, a complete circle or girdle of bone; or, in other words, a short canal or tube which has two outlets. Of these, the anterior is called the *inlet* or *brim,* which is marked more or less distinctly by a line which runs from the top of the symphysis pubis to the first sacral vertebra. The axis of this is—owing chiefly to the obliquity of the innominate bones—never parallel to the vertebral column, but diverges from it more or less widely, according to what is termed the "inclination" of the brim. The *outlet* looks backwards or downwards according to the posture of the animal, and is bounded in the dorso-ventral diameter by the caudal vertebræ on the one side, and the lower margin of the symphysis on the other, and laterally by the great sacro-sciatic ligaments (or bones) and the converging borders of the ischia. As the planes of brim and outlet are never quite parallel, the axis of the pelvis is consequently more or less of a curve.

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[1] See Flower's "Osteology of the Mammalia." London, 1870.

A careful study of the form, and extent of development, in the various mammalian groups, shows clearly that, as in other parts of the skeleton, the ever-watchful provision by nature of means to an end is here strikingly exemplified. In the Cetacea, where there are no pelvic limbs, the pelvis is composed of two slender bones disunited inferiorly, the chief use of which seems to be to afford an attachment for the crura of the penis and clitoris. In the Armadillo, it is strong and powerful, to aid in the support of the exo-skeleton. In the Carnivora, the ilium and ischium are in a straight line and of nearly equal length, the pelvis being thus elongated and narrow. The symphysis is long, includes part of both pubis and ischium, and, in adult animals of this class, is usually closed by anchylosis. In the Seals, the pelvis is small and of a different form from the terrestrial Carnivora, the ilia being small, and the ischial and pubic bones long and slender. The symphysis is small and loose, admitting of being widely separated during parturition.

In many of the Insectivora, the symphysis is absent, the bones being widely separated in the middle line. The pelvis of the mole, for example, is long and narrow, and its axis is nearly parallel with the vertebral column. The ischium, as well as the ilium, is united to the sacrum by anchylosis, and the brim is so narrow that, there being no union at the symphysis, the pelvic viscera lie external to the cavity, and parturition takes place beneath rather than through the pelvic canal. In the Rodentia the ischial and pubic bones are always largely developed, flat, and diverging posteriorly, while the symphysis is long and usually osseous. The guinea-pig is an exception, as here the union remains ligamentous, and admits of free opening during labour.

In the order Ungulata, the Pecora or true ruminants are characterized chiefly by the great development of the ischial tuberosities, forming a well-marked conical process which is diverted outwards on each side. The symphysis is long, and includes a considerable portion of the ischia, and large epiphyses are observed, forming the articulating surfaces. These parts ultimately become fused by anchylosis. In the Perissodactyla, the greater expansion of the ilia, as seen in a marked degree in the skeleton of the elephant, indicates, at first sight, an approach to the human type; but the narrowing of the pelvis at the level of the acetabula, and the comparatively small ischial and pubic portions, at once dispel the illusion.

The Edentata have the pelvis more or less elongated, and the ischia largely developed. In almost all, the ischia are directly connected with the vertebral column by one or more osseous bridges, the single one in the sloth passing from the ischial spine, and thus representing the lesser sacro-sciatic ligament. This is carried to the greatest extent in the Armadillos, where a long unyielding tube is formed by the coalescence of the ilium and ischium on the one hand, and a considerable number of sacral and pseudo-sacral vertebræ on the other. In most of the Edentates, not only the sacro-iliac articulations, but also the symphysis pubis, are anchylosed.

The Marsupiata and Monotremata are characterized by the great development of the ischial and pubic bones, and the development in the tendon of the external oblique muscle of the "marsupial" bones.

The facts here cited will suffice to show that the pelvis, in the various groups into which the mammalia have been divided, is formed so as to suit the requirements of the individual. The mode of locomotion, be it leaping, running, or swimming, is revealed to the anatomist by an examination of the pelvic bones, and in every case it will be seen that the preponderance of ilium, ischium, or pubis, is due to the necessity which exists for certain mechanical arrangements, by which alone can the required muscular power be effectively applied to the bony levers. The pelvis is also an efficient support to the organs which are usually contained within it, and especially to those which are connected with the function of generation.

Obstetrical Functions of Pelvis.—The obstetrician, however, looks at the pelvis from a different point of view. In it he sees the osseous canal through which the product of conception must pass in the act of parturition. He sees in it also the protecting frame-work which shields the generative viscera from the effects of shock or injury. And, above all, he studies it as a structure which, if abnormal, may seriously obstruct the process of parturition. Let us look, then, for a moment, before quitting the subject, and from this standpoint, at the pelvis of the mammalia. Throughout the whole series, irrefragable evidence is afforded that the pelvis is designed with a direct reference to the propagation of the species; and we find moreover, that, on the approach of labour, certain modifications of structure which then occur, clearly prove that nature prepares the parts beforehand for the new function. Thus, in the Chevrotains, a group of little deer-like animals, formerly associated with the

Fig. 1.

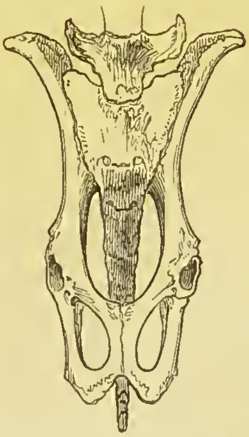

Fig. 2.

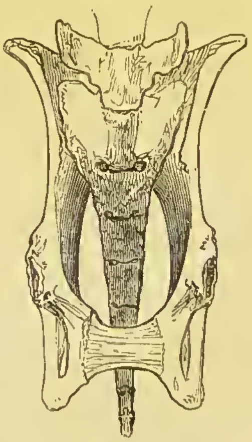

Fig. 1.—Pelvis of the Female Guinea-Pig.
Fig. 2.—The same; showing the separation of the bones during parturition.

musk-deer, the ischia in the males join the elongated sacrum by ossification of the sacro-sciatic ligaments, but in the females the latter retain their normal structure. In the prolific guinea-pig, again,[1] the pelvis is long and laterally compressed, the passage being much narrower than the diameter of the head of the mature fœtus. About three weeks before parturition, the inter-pubic ligaments become soft and elastic, so that during labour the innominate bones separate from each other at the symphysis, the sacro-iliac joint thus becoming on each side a hinge (see Fig. 2.) After this process, the symphysis quickly returns to its former state, and in a few days presents only a little thickness and mobility. The young of the guinea-pig are far advanced at birth: some of the deciduous teeth are shed *in utero*, and they run about and begin to eat soon after they see the light.

In the Cow, as the period of parturition approaches, a relaxation of the pelvic ligaments also occurs, but the process here is different.[2] The gradual upward curve and posterior projection of the ischia causes the well-marked dorsal prominence of their tuberosities, which appear distinctly on the rump, projecting on each side and above the coccygeal vertebræ. By this elevation of the ischia, the sacro-sciatic ligaments become a means of support to the pelvis, so that their action is inverted as compared with the corresponding structure in the human pelvis. As the period of utero-gestation approaches its termination, these ligaments, as well as those of the sacro-iliac joints, become relaxed to such an extent that the sacrum is observed to sink downwards between the innominate bones, so that the ischial tuberosities become very prominent, and relatively elevated. The object of this is manifestly to render parturition easier. Did this, indeed, not occur, there can be little doubt that in the cow the difficulties of labour which occasionally arise would be of much more frequent occurrence. It is interesting to observe, as the probable cause of dystochia in those animals, that, owing to the greater curve of the sacrum, the axis of the pelvis is necessarily more strongly curved than usual, and in this respect approximates to the human type.

The Pelvis in the Primates.—If we now turn to the Primates, we shall be able to show, by a comparison of the human race with those of the mammalia which stand nearest to it in the scale, that the process of childbirth must be more difficult and more obnoxious to serious hindrance than in any—even, the highest—of the other mammalia. In all the Simiadæ, the ilium is, as compared with man, much elongated. "Each os innominatum in the adult male gorilla," says Owen, "is one foot three inches in length, that of man being seven inches and a half; the breadth of the ilium is eight inches and a half, that of a man being six inches." In the lower forms—as the baboons and monkeys—the ilium is even longer, relatively to the other bones of the pelvis, than is here described. The ilia are nearly in a straight line with the vertebral column, and the inferior rami of the ischia are directed almost horizontally inwards, entering into the formation of the pubic symphysis, which, in the ape tribe generally, may be more properly called the *ischio-pubic* symphysis. The form of the cranium is the familiar and ready test, not only in distinguishing between man and the lower animals, but also between the various races of mankind. It is peculiarly interesting to us, however, to observe that a careful examination of the pelvis will also supply equally reliable information. The chief peculiarities of structure which are exhibited in the case of the highest of the Simiadæ have just been noticed. In addition, we observe that the *depth* both of the true and false pelvis is much greater than in the human race, that the sacrum is much narrower, especially in the chimpanzee, that the ischial spines are more closely approximated, and, above all, that the antero-posterior measurements at the brim prevail greatly over the transverse.

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[1] Owen—"Comparative Anatomy and Physiology of the Vertebrates."

[2] Todd's "Cyclopædia of Anatomy and Physiology." Supplement. 1859. Art. "Pelvis."

Were we to compare the pelvis of the highest apes with the typical form in man, we would find the following broad points of distinction. In the ape, a pelvis with the brim much more inclined, its antero-posterior exceeding its transverse measurement; a bending of the pelvic brim at the ilio-pectineal eminence, forming an angle of about 120°, called the *ilio-pubic angle*—a characteristic which, without exception, distinguishes the lower animals possessing pelves; a marked elongation of the ilia; and a parallelism of the symphysis with the vertebral axis. In man, less inclination of the brim, and a marked preponderance of the transverse over the antero-posterior diameter; the boundaries of the brim, here alone in the animal kingdom, *on one plane;* great expansion of the ilia, as compared with their length; and the symphysis forming an angle with the vertebral column. The import of this great gap in development is evident, and has its explanation in the adaptation of man alone of all created beings *to the fully erect posture.*[1]

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[1] The characteristics above described are best seen in the European pelvis. A degraded type of pelvis has, however, been described as existing in some races low in the scale, such as the Australian aborigines, in which the conjugate diameter is said to equal, and, in rare instances, even to exceed the transverse.

The descriptive anatomy of the human pelvis will form the subject of another chapter. We shall here glance only at its special functions, in so far as they may be held to differ from those of the lower animals. In all the other mammals, the habitual and only natural position or posture of the animal is prone—the dorsal surface being superior, the ventral inferior. In those in which pelvic limbs exist, the weight of the posterior or pelvic portion of the trunk alone is transmitted through the pelvis to the cotyloid cavities, and thence transferred to the heads of the thigh bones. In man, the whole weight of the body above the pelvis is directly transmitted to it by the imposition of the last lumbar vertebra on the base of the sacrum, from which again it is transferred when the body is erect to the femora, and in the sitting position, to the tuberosities of the ischia. To enter upon an analysis of the mechanical laws upon which this depends would be suitable to a work on animal physics, but we must here confine ourselves to such points only as are german to our subject.

The sacrum—which is relatively much broader and stronger in man than in any of the lower animals—is the part which receives the weight of the trunk, the centre of gravity being, according to Weber, 8·7 millimeters above the sacro-lumbar joint, or just above the pelvic arch. It has been compared by Cruveilhier to a wedge, by others to the keystone of an arch, and by Sir Charles Bell to the heel of a mast,—the base of the vertebral column being fixed so that the interval between the innominate bones may be looked upon as the *step* in which the vertebral mast is socketed and mortised. In any case we may consider the weight as being transmitted from the sacro-iliac joints in one of two directions: in the erect posture, it passes through the irregular, thick, and curved buttresses which are formed by this portion of the ilia directly to the cotyloid cavities; in the sitting posture it passes, on a posterior plane, from the same joints almost directly downwards to the tuberosities of the ischia. The sacrum is thus described as forming the common culminating point of two arches—viz., the *cotylo-sacral* or *standing arch*, and the *ischio-sacral* or *sitting arch*. The extremities of these arches are prevented from starting outwards, not by abutments as in the ordinary architectural arch, but by connecting links or *ties*, which are represented in the cotylo-sacral arch by the horizontal pubic rami, and in the ischio-sacral by the united ischio-pubic rami. This complicated arch acts also by preventing inward pressure, in the erect posture, by the head of the femur; while shock is in a great measure obviated by the oblique manner in which the sacrum is placed—the sacro-sciatic ligaments preventing the movement of the coccyx upwards and backwards, while the ilio-lumbar ligaments prevent the corresponding motion of the base of the sacrum downwards and forwards.[1] The expanded external surfaces of the ilia give attachment to the mass of the glutei muscles, more powerful, for obvious reasons, in man than in any other animal.

But the pelvis has, in addition to the elaborate mechanical functions above shortly alluded to, a new and special function thrown upon it in man. This is the support of the pelvic viscera, including the organs of generation. These latter being larger and heavier in the female, and, in view also, no doubt, of the requirements of the pregnant state, nature here makes special provision for their accommodation, in the greater capacity and modified form to which we shall afterwards advert. In the lower animals, the abdominal viscera, and, to some extent also, the pelvic viscera, are supported by the lower abdominal wall. The contents of the pregnant uterus, therefore, gravitate downwards in the direction of the arrow in Fig. 3, and, under no circumstances, does the weight of the uterine contents press into the cavity of the pelvis. Even in the Simiadæ, where the erect posture is to some extent assumed, the greater inclination of the pelvic brim prevents the gravitation of the uterus and its contents into the true pelvis. In a pregnant woman, on the other hand, not only are the pelvic viscera proper supported by the structures which form the floor of the pelvis, but some support is indirectly afforded to the abdominal viscera under certain circumstances. In the pregnant state, the uterus and its contents gravitate to a considerable extent downwards and backwards in the axis of the brim.

Fig. 3.

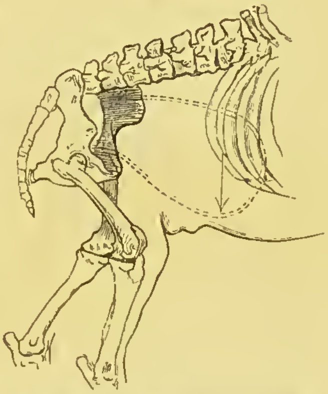

Diagram showing the direction in which the uterine contents gravitate in the Mammalia generally.

The necessity which thus exists for efficient pelvic support to these parts has not been overlooked. Were the pelvis a simple tube, with the inlet looking upwards, and the outlet downwards, it is obvious that no efficient support could be afforded. But the tube, far from being straight, is in a woman strongly curved—so strongly indeed, that a line drawn so as to represent the axis of the brim and the long axis of the uterus (which we may here assume to be identical) will not fall within the plane of the outlet at all, but behind it, somewhere about the centre of the coccyx. By this curve in the pelvic axis, the lower part of the sacrum, the coccyx, the sacro-sciatic ligaments, the *levatores ani* and *coccygei* muscles, with the fasciæ and soft structures, form a firm *Floor*, by which, in a normal and healthy condition of the parts, perfect support is given to the structures of which we have spoken. But this manifest advantage is obtained at the price of increased difficulty in the act of parturition. This difficulty is, no doubt, to a very great extent compensated for by the development of the sub-pubic arch, a peculiarity of the human species which is but imperfectly developed in the lower animals. Without this, indeed, and that shortness of the symphysis in women which admits of the widest development of the arch, labour would be always difficult and often impossible.

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[1] Dr. Matthews Duncan, in his "Researches on Obstetrics," 1868 (p. 55), shows more correctly, that the weight is transferred from the sacrum to the cotyloid cavity, not directly, but indirectly through the agency of the posterior ilio-sacral ligaments.

The function of the pelvis being thus in every case a complicated one, is so in the human female in an especial degree. The unyielding nature of the structure, essential to the effectual support of the trunk, and the curving of its cavity for the reasons above stated, render child-bearing, in this instance, exceptionally liable to dangers of various kinds, and thence arises the necessity for that thorough professional training which can alone engender confidence and develop skill.

The comparative facility with which parturition is effected in the lower races of the human species has also been used as an argument against the practice of midwifery. In reference to this objection, on which we need not dwell, there can be little doubt that the effect, in certain classes of society, of modern and luxurious habits, exercises no inconsiderable influence upon the physiological phenomena of parturition. As regards the difference between the races, many very interesting facts have been revealed by the researches of Vrolik, Weber, and others, but there is still, in this direction, a wide field for original investigation. The facts which already have been disclosed point to the important conclusion that there subsists in the various races a remarkable coincidence between the prevailing form of the skull and the diameters of the pelvic brim, and that, consequently, the adaptation of the fœtal skull to the pelvic passage during labour must be greatly facilitated. Weber's conclusions, drawn from the examination and measurement of a considerable number of crania, are, that we may admit, as the general rule (subject however to numerous exceptions), that the oval shape is most common in Europeans, the round shape in the American aborigines, the square shape in the Asiatic or Mongolian type, and the oblong in the Negro races. As regards the assumed facility of labour in the latter, there is every reason to believe that this has been greatly exaggerated, and that cases of dystochia, though comparatively rare, are yet not unfrequent. If the pelvis were the same in size and proportion in them as in Europeans, the inferior cranial development would afford an obvious explanation of the alleged fact of habitually easy labours. So far, however, from this being the case, we have just seen that the form of the pelvis corresponds to the shape of the head. An examination of Negro, Bushman, and other pelves, shows in many instances a remarkable degradation of type, such as a vertical direction of the ilia, and their elevation at the posterior superior spines, narrowness of the sacrum, and acuteness of the sub-pubic angle. An occasional peculiarity in some of the lower races, and one which appears even more to approach the ape type, is the preponderance of the conjugate over the transverse diameter of the brim. But they who have asserted that the lower races referred to simulate in this respect Apes rather than Europeans have gone too far, as is clearly proved by the measurements given in Wood's admirable article on the pelvis in Todd's Cyclopædia, already quoted. From this it appears that, while the transverse diameter may, in the higher Simiadæ, measure less than the conjugate by one and a half to two inches, the difference in cases of oblong pelvis in Negroes is merely fractional, and that the type is in every case far more closely allied to the European than to the Simian, where the conformation of the pelvis is such, even in the highest forms, that its marked peculiarities are appreciated at a glance.

Mobility of Pelvic Articulations.—Whether the pelvic articulations in women are, or are not, divaricable during parturition, is a question obviously of great practical importance to the accoucheur. Involving, indeed, as it does, practical considerations, this is a subject, the study of which might here be considered premature. But, in view of the facts which have just been stated in relation to the comparative anatomy of the pelvis, this vexed question may, we believe, be noticed with more advantage at this stage than at any other. In so far as a study of the physiological phenomena of labour in the lower animals can throw light upon the subject, we have already seen that separation may take place to a very considerable extent at the symphysis, as in the guinea-pig (see Fig. 2), or at the sacro-iliac joint, as in the cow. So far, then, analogy points to the possibility of such a separation. Besides, anchylosis of either one joint or the other, common as it is in the lower animals, is known to be, in the human species, an extremely rare occurrence.

Actual observation, again, by men of such undoubted authority as Paré, Levret, Smellie, and many others, has proved, beyond all possibility of doubt, that in women who have died during the parturient period, separation of the bones, in some cases at the symphysis and in others at the sacro-iliac joints, has been seen and recorded. Few practitioners of extended experience have failed to observe that women occasionally complain, it may be either before or after labour, of pain in the neighbourhood of these joints, difficulty or inconvenience in walking, and, more rarely, of a grating or crepitant feeling, arising obviously from an unwonted motion of the articulating surfaces upon each other; from which we may conclude that separation may, to some extent at least, occur. Cases such as have been detailed by Soemmering—where the bones at the sacro-iliac joint have been found separated to the extent of an inch—have been supposed to be the result of disease and deposit of pus.

Admitting, then, that some separation does occasionally occur, are we to assume that this is to be held as abnormal and morbid, or admitted as one of the essential physiological phenomena of human parturition? It is, we suppose, now universally believed that, during the last months of pregnancy, the cartilaginous and other structures forming these joints, to be hereafter described, become softened, as if by serous infiltration. The synovial membranes, indistinct before, now become capable of demonstration; and, more important, perhaps, than all, the tissues become thickened, while the ligaments of the joints are relaxed. The effect of such thickening must, of necessity, be, like ivy roots in a wall, to force the bones asunder and, consequently, to increase the pelvic diameters. If, however, there is, as has been asserted, a yielding much more extensive than this, such motion may be assumed to occur in one of two ways: either by a separation at the pubes, involving a hinge motion of the sacro-iliac joint, as in guinea-pigs, or by a movement of the sacrum between the ossa innominata, involving a hinge motion of the symphysis, as in the cow. As regards the first of these, a careful examination of the circumstances under which it may occur, would seem to indicate that a separation of the pubic bones, to the extent even of an inch, would add very little to the diameters of the brim, and would contribute least of all to the smallest or conjugate diameter. The analogy which the frequent yielding of the symphysis seems to reveal, gave rise, about the end of the last century, to an operation consisting in the artificial section of the symphysis in cases of obstruction at the brim—a mode of procedure which Dr. Matthews Duncan seems to think has been in these days too completely consigned to oblivion.

The other method in which the pelvic capacity may be increased by a movement of these joints, is by the motion of the sacrum between the ossa innominata, somewhat as it has been shown to occur in the cow.[1] From what has already been said, it may be inferred that to compare the sacrum either to a wedge or a key-stone is very far from accurate. We have seen that this bone, besides its union with the sacrum by means of intervening cartilage, is maintained in its position by the ilio-lumbar and sacro-sciatic ligaments, the former preventing, or rather strictly limiting, along with other forces, the downward and forward movement of the promontory, while the latter limits, in like manner, the upward and backward motion of the coccyx. Now, these ligaments share in the general relaxation of the pelvic structures towards the end of gestation; and thereby we may assume, that the movement or oscillation on its transverse axis, of which the sacrum is capable, and which is said by Zaglas to be about a line in the unimpregnated condition, is, in the last months of pregnancy, considerably increased. The manner in which this oscillation of the sacrum takes place in different positions of the woman is clearly shown by Zaglas. "In the erect position, the promontory of the sacrum is not in the position of greatest projection into the brim of the pelvis, but the reverse; and, consequently, the apex is in its forward position, diminishing the outlet and relaxing the sacro-sciatic ligaments. When the body is bent forward, on the other hand, the base of the sacrum is protruded into the brim, the apex is tilted upwards, the sacro-sciatic ligaments put on the stretch, and the outlet of the pelvis consequently enlarged. These movements take place, ordinarily, both in man and woman, in defæcation, &c., but in her they are of greatest interest and importance in the function of parturition."[2] The backward motion of the coccyx has also the effect of producing lateral widening of the pelvis, by bringing a wider part of the base of the sacrum between the ilia. This, of course, supposes some gliding motion in the sacro-iliac articulation, or, at least, yielding of the parts. The experiments of MM. Giraud and Ansiaux seem to show that, in contracted pelves, the movements take place to an even greater extent, as if nature were doing her utmost to obviate the disastrous effects of pelvic

Fig. 4.

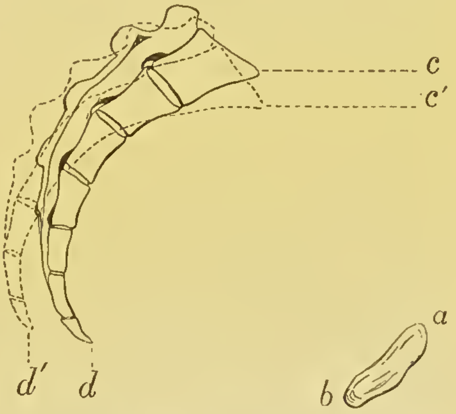

Diagram showing the oscillatory movement referred to. (Matthews Duncan.)

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[1] Barlow. Monthly Journal of Medical Science.—January, 1854.

[2] Matthews Duncan. Op. Cit., p. 142.

deformity. Dr. Matthews Duncan, in his admirable essay on this subject, points out, with great clearness, the very remarkable manner in which these alterations correspond with the phenomena of the progress of the child in parturition. In the first stage of labour, for example, when the head is passing through the brim, the woman prefers the standing, sitting, or reclining posture, in which the brim of the pelvis is, as we have seen, kept open at the expense of the outlet (see Fig. 4); but in the second stage she bends her body forwards, draws up her legs, and calls into action the abdominal muscles, which act by tilting up the symphysis; in a word, her posture and voluntary efforts are now precisely those which may most effectively increase the conjugate diameter of the outlet by tilting back the coccyx. To the motion of the sacro-coccygeal joint, which is universally admitted, we need not at present specially advert.

From these and other facts disclosed up to the present time, we conclude:—1st, That, in the last months of pregnancy, a marked relaxation and softening of the pelvic articulations takes place.

2nd, That, as the result of this modification in structure, an increased, though limited, mobility is permitted, which tends to facilitate labour.

3rd, That, in addition to the movement of the sacrum on its transverse axis above noted (which may be considered as peculiar to the human species), the manner in which the joints yield is probably very similar to what obtains in the case of the cow. The sacrum acts in this case as a wedge separating the ossa innominata and causing the symphysis to open with a hinge motion, while, during the violent efforts of labour, the whole sacrum may probably be driven backwards to a trifling extent. Separation of the bones at the symphysis is occasionally observed, but this is the exception, whilst the other is the rule. The development of the synovial membranes seems, when taken along with the above facts, to warrant the conclusion arrived at by Lenoir, "that the articulations of the pelvis proper should not be considered as *amphiarthroses*, but as *arthroses*."

Definition of Midwifery.—The word "Midwifery," it is proper here to state, is employed in this work in the more extended sense in which it is used by Rigby and other English authors, and not in the limited sense which is implied by the French *accouchement*, and the German *Geburtshülfe*. It signifies, therefore, that Science and Art which has for its object the management of woman and her offspring during Pregnancy, Labour, and the Puerperal State.

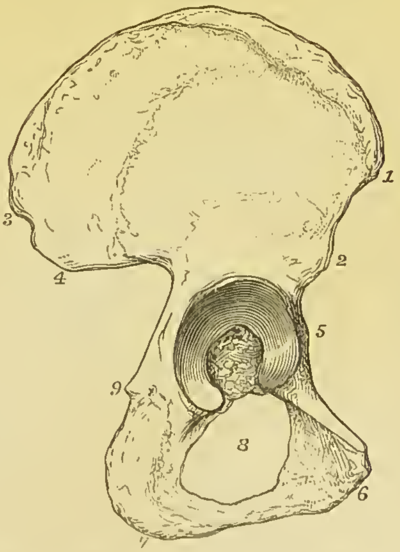
CHAPTER II.

THE PELVIS.

Os Innominatum : Sacrum: Coccyx.—The Pelvis as a whole : " True " and " False." —Difference between Male and Female Pelvis : at Brim ; in Cavity ; and at Outlet.—Pelvic Articulations : (a) *Pelvi-Lumbar ;* (b) *Sacro-Coccygeal ;* (c) *Sacro-Iliac ;* (d) *Symphysis Pubis ;* (e) *Obturator Ligaments ;* (f) *Sacro-Sciatic Ligaments.—Inclination of Pelvis.—Axis of the True Pelvis.—Brim or Inlet.—Cavity.—Outlet.—Pelvic Diameters.—Pelvic Angles.—Development of Pelvis.—Certain Soft Parts connected with Pelvis ; Obturator Internus and Pyriformis Muscles ; " Floor " of Pelvis.*

THE Pelvis, as has already been observed, is composed in Man, as in almost all the other Mammalia, of, 1st, two *Ossa Innominata*, each being formed by the union of three principal pieces, the *ilium*, *ischium*, and *pubis*, and some other epiphysial parts, the complete fusion of which into one mass is only complete about the twentieth year ; 2nd, the *Sacrum* ; and 3rd, the *Coccyx*.

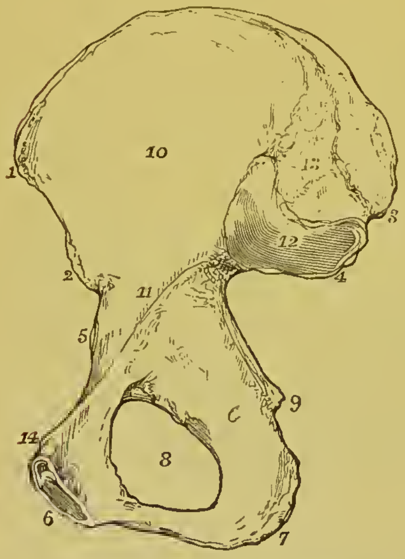
Fig. 5.



External Surface of right Os Innominatum.

The Os Innominatum on its external surface exhibits the remarkable expansion of the ilium which constitutes one of the distinguishing features of the human race. This large surface serves to give attachment to the powerful glutei muscles. Its superior margin is called the crest of the ilium ; the projections at 1 and 2 the anterior, and those at 3 and 4 the posterior spinous processes. The acetabulum, also called the cotyloid cavity, a deep cavity for the reception of the thigh bone, with its synovial depression and pit for the reception of the round ligament, is shown in the centre of the figure: 5 marks the pectineal or ilio-pectineal eminence, a point of some importance in midwifery; and the other parts indicated are, 6, the symphysis pubis; 7, the tuberosity of the ischium; 8, the thyroid or obturator foramen; and 9, the spine of the ischium, which divides the great posterior gap into the greater and lesser sciatic notches.

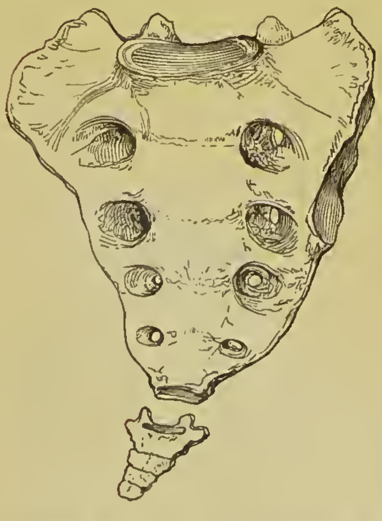
Fig. 6.



Internal surface of Os Innominatum.

In the view of the internal surface of the innominate bone, the figures 1 to 9 indicate the same parts as in the preceding cut; 10 is the iliac fossa; 11, the ilio-pectineal line or brim of the true pelvis; 12, auricular cartilaginous surface of the sacro-iliac joint; 13, rough tuberculated surface for the posterior sacro-iliac ligaments; 14, spinous process of the pubis, terminating the crest of the pubis and the ilio-pectineal line. The relative position of the rami of the ischium and pubis, and other points familiar to the anatomist, are clearly shown in both figures.

Fig. 7.



Sacrum and Coccyx—Anterior surface.

The Sacrum is an irregular wedge-shaped or triangular bone, formed by the fusion of five vertebræ, and is more or less curved with the concavity forwards, the base of the triangle being upwards. It is placed below the last lumbar vertebra, above the coccyx, and between the ossa innominata, and forms the upper and back part of the pelvis. It is in man stronger, and relatively larger, than in any other animal. The external or posterior surface is convex and rough, and there are four, and sometimes five, processes placed below each other in the median line, representing the spines of the original vertebræ. On either side, four foramina are observed, through which the posterior sacral nerves pass from the *cauda equina*, which is contained in a longitudinal canal, the continuation of that of the vertebral column. Below the last spinous process, is a triangular opening, which is the termination of the vertebral canal, and of which the lateral margins terminate in a pair of tubercles. These, which project downwards and articulate with the cornua of the coccyx, are known as the sacral cornua. A row of tubercles is seen on the inside, and another on the outside of the foramina,—corresponding to the articulating and transverse processes of the vertebræ.

The pelvic or anterior surface (Fig. 7) is concave from above downwards, and slightly so from side to side, and is much smoother than the posterior. Four foramina, larger than those above described, are provided for the transit of the anterior sacral nerves; and between the foramina are four ridges, indicating the boundaries of the original vertebral constituents of the bone.

Laterally, there is presented anteriorly an uneven surface of considerable size, covered in the recent state with cartilage, and corresponding to the iliac articulating surface shown at 12, Fig. 6. This is called from its shape the auricular surface; and behind it there is an extremely rough and uneven surface for the attachment of the posterior sacro-iliac ligaments. Below and behind this, the irregular surface gives attachment to the sacro-sciatic ligaments.

The oval surface of the sacrum, which, looking upwards and forwards, represents the base of the bone, is articulated, through the medium of the inter-articular disc, with the last lumbar vertebra; while its narrow inferior extremity, transversely oval, is jointed with the superior surface of the Coccyx.

The Coccyx, the rudiment of the caudal vertebræ, generally consists of four small vertebral pieces tapering downwards to a point. It derives its name from a fancied resemblance to a cuckoo's beak, and is placed so as to continue, anteriorly and posteriorly, the curve of the sacrum. An oval surface (covered with cartilage and furnished with a synovial membrane) articulates with the apex of the sacrum; and this union is strengthened by two small processes which project upwards to meet the cornua of the sacrum. Not only is the sacro-coccygeal joint a perfect hinge, but the various bones of which the coccyx is composed also admit of some motion in early life the one upon the other. In adult life these bones are generally anchylosed, and the sacro-coccygeal joint is, in males generally, and in females occasionally, lost, so that the sacrum and coccyx are firmly joined together.

The superior mobility of the coccyx in women is universally admitted as an important mechanical advantage in the process of parturition, the antero-posterior diameter of the outlet being in this way increased, under ordinary circumstances, by an inch or even more. Usually, during the child-bearing period, the parts are in the condition of complete mobility as regards the sacro-coccygeal joint, and yielding also between the first and second bone of the coccyx, while the last three bones are united.[1] In this respect, however, great irregularities exist, and sometimes, even in women who are still young, complete anchylosis is observed. The result of this is, of course, a very considerable impediment to delivery, and cases are recorded where, during the use of instruments, or even in the course of ordinary labour, a fracture of the bones thus anchylosed has occurred. Premature fusion of this articulation, and malformation of the coccyx are conditions by no means very uncommon. The usual form assumed in the latter case is projection forwards, encroaching upon the conjugate diameter of the outlet; but a projection of the coccyx backwards has also been noticed by the writer and others, a condition which is interesting as an anatomical peculiarity, but is rather favourable than obstructive to the course of natural labour. In cases of fracture, care must be taken, during the reparative process, to prevent union in such a position as to constitute a possible impediment to delivery in subsequent labours.

The Pelvis as a Whole.—The Pelvis is thus formed by the union of several pieces, the articulations or points of junction being, in front, the *symphysis pubis*, and, behind, the *sacro-iliac* and *sacro-coccygeal* joints. These articulations are greatly strengthened by certain ligamentous structures which will be presently described.

It is divided into two parts by a line, the various parts of which are in man alone on the same plane. This, known as the *ilio-pectineal line*, marks the *brim* or *inlet* of the pelvis, and forms an irregularly oval constriction of the osseous canal. Various points in the course of this line, which divides the superior or *false* from the inferior or *true* pelvis, are of special interest to the obstetrician. In the middle line anteriorly is the symphysis pubis. Diverging right and left from this point, are the pubic crests, terminating in the pubic spines. The finger, on being passed around, next touches the *pectineal* or *ilio-pectineal eminence*, then the ilio-sacral articulation, and finally the projection known as the *promontory* of the sacrum. This last point is of paramount importance, as the degree of projection which forms the promontory exercises a most important influence during labour.

The true pelvis, then, includes the whole of that part of the structure which is below the brim as far as the *outlet*, the space comprised between the two being the *cavity.* Each of these parts requires careful and separate consideration; but, before passing to this part of the subject, it is advisable that the striking contrast between the male and female pelvis, having an obvious relation to the function of parturition, should be noticed.

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[1] Cazeaux asserts that the sacro-coccygeal articulation ossifies generally before the first and second bones become united. If this is correct, the mobility in these cases must manifestly be impaired.

Male and Female Pelves.—The female differs from the male pelvis, in the first place, by the comparative slenderness of the bones, as is well seen in the rami of the ischium and pubis, and also by the greater smoothness of the surfaces to which muscles are attached. The chief points of distinction, as viewed from before, are well shown in Figs. 8 and 9, in both of which the numbers 1 and 2 represent the extremities of the widest transverse diameter of the upper or false pelvis; 3 and 4 are the acetabula, right and left; 5, 5, the thyroid or obturator foramina; and 6, the sub-pubic angle or arch. The differences exhibited are those which exist between an ordinary male and female pelvis in middle age: in neither case is there anything exaggerated or unusual. The greater distance in Fig. 9 between the acetabula, the wider and shallower true pelvis, the triangular form of the obturator foramen, the greater width between the tuberosities of the ischia, and the greater span of the sub-pubic arch, are the chief points which at a glance show it to be a female pelvis. The last-mentioned point of distinction is very charac-

Fig. 8.

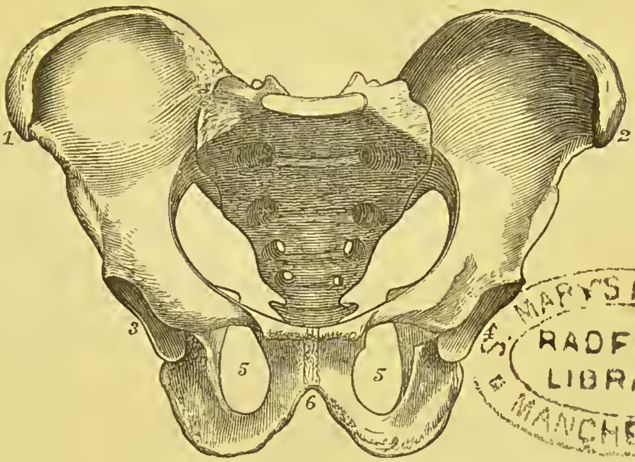

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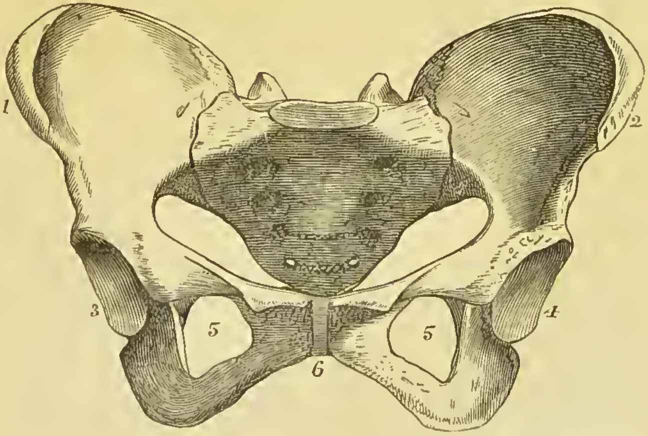
Fig. 9.



Male and Female Pelves contrasted, as seen from before. (Quain.)

teristic in well formed pelves, the angle in the male being no more than 75° to 80°, whilst in the female it ranges from 90° to 100°.

Viewed from above and in front, in the axis of the Brim, the contrast is scarcely less marked. In the lower of the two figures, showing this view, the further peculiarities of the female pelvis are evidenced by the greater expansion of the ilia, the minor degree of projection of the promontory of the sacrum, and the marked general increase in the diameters. In the Cavity, the most noteworthy feature of the female pelvis is its comparative shallowness, the symphysis being much shorter, while the sacrum is both shorter and broader, and disposed so as to afford a more ample concavity. It will also be noticed, in looking downwards and backwards, as is shown in Figs. 10 and 11, that three projections are seen—posteriorly the sacrum and coccyx, and on either side the converging ischial planes, culminating in the ischial spines. These projections, encroaching, as they manifestly do, on certain measurements of the lower parts of the pelvis, have, as will be explained afterwards, a very important bearing upon the mechanical laws which govern the process of parturition.

Fig. 10.

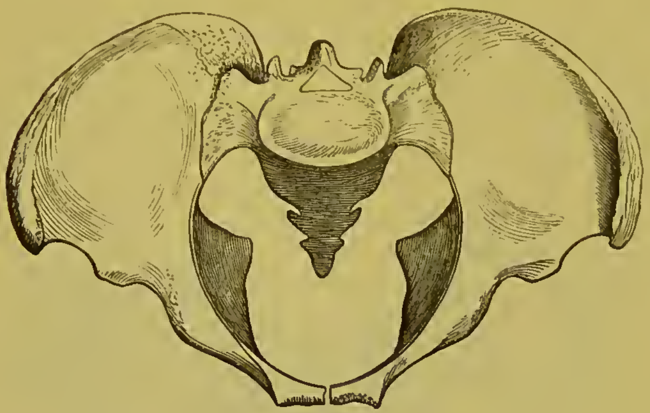
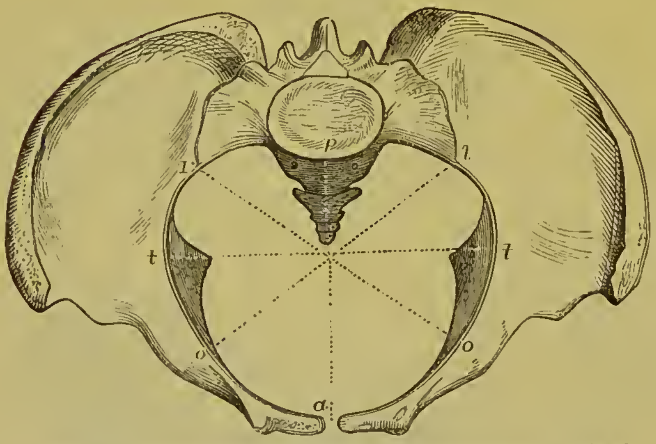


Fig. 11.



Male and Female Pelves contrasted, as viewed in the Axis of the Brim. (Quain.)

If, again, we look at the bony Outlet, we find here also three projections, posteriorly the sacrum and coccyx, and at the sides the ischial tuberosities. Between the latter is the sub-pubic angle, while between them and the sacrum on each side is the irregular sacro-sciatic gap, partly closed, as we shall see presently, by powerful ligamentous structures, and much more spacious in the female than in the male.[1] These, the main features which enable us to distinguish between the male and female pelvis, having now been noticed, we shall advert in future to the female pelvis alone.

Pelvic Articulations.—The ligaments and articulations which bind the various parts of the pelvis together may now be briefly noticed.

a. Pelvi-lumbar articulation.—In addition to the intervertebral disc and the ligaments, which are strictly analogous to those existing between the vertebræ above, attention must here be paid to the *sacro-vertebral* and *ilio-lumbar* ligaments. The former passes, expanding as it descends, obliquely from the tip of the transverse process of the last lumbar vertebra, to the depressed lateral part of the base of the sacrum; the latter horizontally between the tip of the transverse process of the last lumbar vertebra and the posterior margin of the iliac fossa, where it somewhat expands.

b. Sacro-coccygeal articulation.—An anterior and posterior ligament, and an intervertebral disc, are here found as in the more perfect vertebræ. There is observed besides in women, and in a lesser degree in the male sex, a synovial membrane, which converts this into a perfect hinge joint, the structure and mobility of which become, as has already been mentioned, much more obvious in the latter stage of pregnancy.

c. Sacro-iliac articulation.—The bones are here joined by a twofold union; in the first place, by the cartilaginous auricular surfaces which are seen anteriorly when the parts are forced asunder, and from which the name *synchondrosis* is often given to the joint. Generally, these surfaces are closely united; but in pregnancy, and, probably, under certain other circumstances, an indistinct synovial cavity may be demonstrated, admitting, as there is every reason to believe, of a certain amount of motion. This union is greatly strengthened by the posterior sacro-iliac ligaments, consisting of strong irregular bands of fibres which pass from the overhanging portion of the ilium to the contiguous rugged projections on the lateral surface of the sacrum. One of these bands, extending downwards from the posterior superior iliac spine to the third or fourth piece of the sacrum, in a direction different from the other fibres, is known under the name of the oblique sacro-iliac ligament. An anterior sacro-iliac ligament is also described, but is of little anatomical importance.

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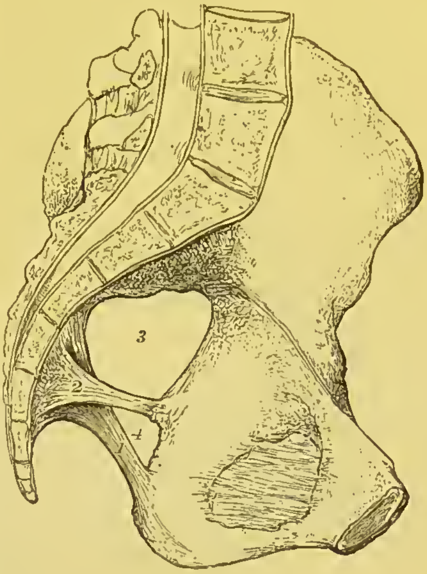
[1] The greater expansion of the ilia, and divergence of the cotyloid cavities, give the chief peculiarities to the female figure, in regard to which the ancient Greek sculptors are probably not far from the truth in representing their ideal of female beauty as measuring a third more across the hips than the shoulders, while these measurements are reversed in the case of Apollo. The same peculiarity occasions the peculiar swinging gait, which is the more marked in a woman the broader the pelvis is in proportion to her height.

d. The Symphysis Pubis.—This joint is, like the previous one, also effected by fibro-cartilaginous plates and ligaments. The two cartilages are thicker in front where they come into contact with each other, and thinner posteriorly, so as to leave a space which is, as in the other joints just described, lined by a synovial membrane. During pregnancy, an effect is produced upon this joint precisely similar to what has been stated to occur in the sacro-iliac joints, but it is in this case even more marked. The articulation is materially strengthened by the ligaments which surround it, named respectively posterior, superior, anterior, and inferior pubic ligaments. Of these, the posterior is a layer of fibres of little strength; the superior is connected with a band of fibres which arises from the spine of the pubis, and conceals the irregularities of the crest of the same bone; the anterior is a layer of irregular fibres passing across from one side to the other, and crossing obliquely the corresponding fibres from the other side, and the inferior, triangular, or subpubic ligament is so thick, and so disposed by its attachments to the rami of the pubic bones as to give smoothness and roundness to the sub-pubic angle, and thereby to facilitate the passage of the fœtus.

e. The obturator ligaments.—These structures, which are more correctly described as membranes, close almost entirely the obturator foramina, giving attachment externally and internally to the obturator muscles, and leaving only a small aperture in their upper and outer part, which serves to transmit the obturator vessels and nerve.

f. Sacro-sciatic ligaments.—These are two in number, longer in the female than in the male, and become, to some extent, relaxed during labour. The *posterior*, or *great* sacro-sciatic ligament (Fig. 12, 1), which is placed in the inferior and posterior part of the pelvis, is broad and triangular in shape, and extends from the inner surface of the ischial tuberosity, which is the apex of the triangle, to the side of the coccyx and sacrum, as far as the posterior inferior spine of the ilium. This extensive attachment constitutes the base. The fibres of the apex expand, so as to send a falciform process upwards and forwards, along the margin of the ischial ramus, to join the fibres of the obturator fascia. 2 is the *anterior* or *small* sacro-sciatic ligament, which is both shorter and thinner than the other, and is also of a somewhat triangular shape. Its fibres are directed forwards and outwards; the fibres constituting its base are blended with those of the larger ligament, whilst its apex is attached to the spine of the ischium. By means of these structures, which are ossified in some of the lower animals, it will be observed that the sacro-sciatic notches are converted into foramina, *great* and *small sacro-sciatic;* 3 and 4. Through the former of these, the pyriform muscle, the great sciatic nerve, and the ischiatic vessels and nerves pass, while the latter admits of the exit from the pelvis of the obturator internus muscle and the internal pudic vessels and nerve.

Fig. 12.



Internal surface of Female Pelvis, showing—1, 2, greater and lesser Sacro-Sciatic Ligaments; 3, 4, greater and lesser Gaps or Foramina.

The obstetrician may look upon these ligaments as discharging a double function. They act, as has already been mentioned, by preventing the displacement of the apex of the sacrum upwards and backwards,—an accident which, without their aid, the very oblique position of that bone would in the erect posture be likely to engender; and therefore, in this sense, they strengthen the sacro-iliac articulation. But, in addition to this, they partly close the large irregular opening which constitutes the outlet of the pelvis; forming, at the same time, the framework of those soft structures constituting the *floor* of the pelvis—which exercise a very important influence on the progress of labour, and act also by affording an efficient and elastic support to organs which would otherwise be liable to frequent displacement downwards.

In addition to the ligaments above described, there are others, some of them—as those of the hip-joint—of great importance; but as they have no special obstetrical interest, their description here may well be omitted.

Inclination of the Pelvis.—If we place the articulated pelvis on a table, so as to bring the tip of the coccyx and the ischial tuberosities into the same horizontal plane, the brim of the pelvis will be found to look upwards and slightly forwards. This was at one time supposed to be the actual position in the erect posture; and many persons now living may remember to have seen articulated skeletons in which the pelvis was so placed. Hence the term "horizontal," which use and wont has attached to the upper of the two rami of the pubis. Naegele was the first clearly to show, not only that this was an error, but that it was a very gross one,[1] and that the pelvis was, in the normal position, inclined forwards, to such an extent that the plane of the brim met the horizon at an angle of 60° or more (Fig. 13, *a*). The same observer, after examining a large number of well-formed female bodies, concluded, further, that the average height of the promontory of the sacrum above the upper margin of the symphysis pubis is about 3¾ inches, and that a line drawn from the tip of the coccyx to the lowest part of the symphysis, formed with the horizon at *b* an angle which varies greatly, but which may be stated, as an average, at about 11°. In reference to this, however, it must be borne in mind, that the recession of the coccyx implies a movement downwards, as well as backwards, and that, consequently, this angle will be rendered still more acute during the passage of the child. The axis of the brim of the pelvis, then, is a line, *c*, *d*, which passes upwards and strongly forwards, while that of the bony outlet is directed downwards and slightly backwards. The axis of the cavity is usually described as the perpendicular of a line drawn from the middle of the symphysis pubis to the centre of the sacro-coccygeal curve.

Fig. 13.

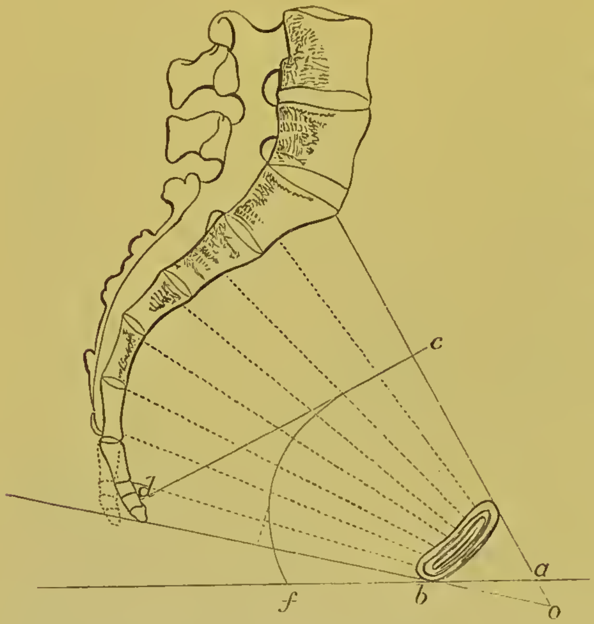


Diagram showing the Inclination and Axis of the True Pelvis.

Axis of the True Pelvis.—If the bony pelvis were a simple cylinder, the demonstration of its axis would be a very simple matter. All that would then be necessary would be to make a section, perpendicular to its walls, when the axis of the cavity would be shown to be a line at right angles to the plane represented by this section, and equidistant from every part of the cylinder wall. The same simplicity of description will not, however, suffice in the case of the irregular and curved pelvic cylinder. What is known as the "curve of Carus" was at one time generally supposed to represent the axis of the pelvis. This curve is described in the following manner:—The compasses are opened to the extent of 2½ inches: one point is placed upon the central point of the posterior surface of the symphysis, while with the other a curve is drawn from the plane of the brim to the plane of the outlet, the arc of the circle thus indicated being assumed to represent the axis of the pelvis. A mere superficial observation of the human pelvis will serve to show that neither this nor the arc of any circle can truly, or even approximately, represent the axis in question.

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[1] "Das weibliche Becken," &c. Carlsruhe. 1825.

Although not absolutely free from technical objection, we may assume that the following more modern view brings us nearer the truth. If we produce the lines in the above diagram, which represent the planes of the brim and outlet, to their point of intersection in front of the symphysis at *o*, and from this common centre draw an infinite number of radii passing through the pelvic cavity, that portion of each radius which lies within the pelvis may be held to represent the plane of that portion of the cavity through which it passes. If we then draw a line which shall pass through the geometrical centre of each of these planes, that line will be found to be a curve, which coincides very closely with the axis of the true pelvis, which is the arc of no circle, and which has been described as an irregular parabola. One point must here, however, be noted—that, as the terminal planes or radii will be modified by the motion of the coccyx during labour, so in like manner will the inferior portion of the curve be proportionally altered. This is indicated in Fig. 13, where the line *c f* marks the parabolic curve or assumed true pelvic axis.

Fig. 14.

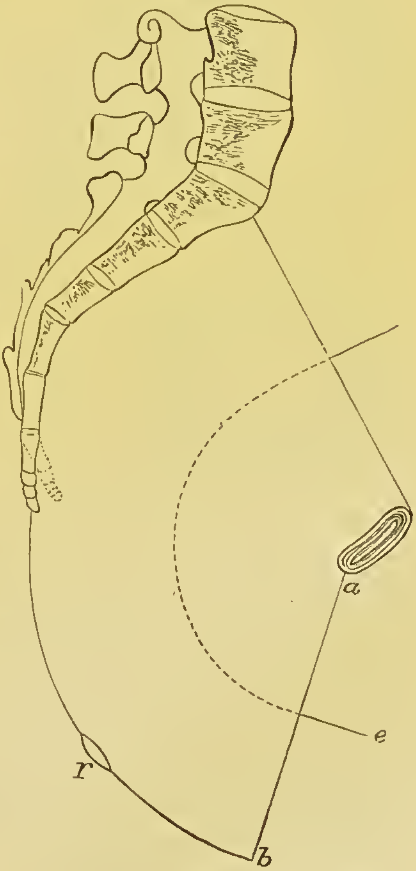

Diagram showing the Axis of the Parturient Canal.

We must here be careful in drawing a distinction between the axis of the outlet of the bony pelvis, and the axis which represents the direction in which the child is born. In considering the latter, it is essential that the soft parts forming the floor of the pelvis should be looked upon as constituting the posterior and inferior boundary of a continuation of the pelvic canal. These parts, which extend from the tip of the coccyx to the posterior commissure of the vagina, are subjected during delivery to an amount of stretching for which nature makes due provision. The margins of the anus are dragged apart, the perineum distended in all directions in a manner apparently incompatible with the integrity of that structure, until ultimately, at the moment of expulsion, the posterior commissure of the vagina is driven downwards and carried forwards to such an extent, that a line drawn from the sub-pubic angle to the edge of the distended perineum, shows the plane of the outlet of the completed pelvic canal to look, not downwards, but almost directly forwards (Fig. 14, *a b*). The line *e*, perpendicular to, and meeting the centre of this plane, is then the *axis of expulsion.* That part of the child which is first born moves upwards and forwards under the pubic arch, and in front of the symphysis, in continuation of the curve indicated in the diagram by dotted lines. Let us now look more closely at the various parts of this tube which attract special notice—viz., the Brim, the Cavity, and the Outlet.

The Brim presents (Fig. 11, p. 26) an irregular oval appearance, the long diameter of the oval being from side to side. It has been found on an average to measure in its *antero-posterior* or *conjugate* diameter (*a p*)—which is taken from the promontory of the sacrum to the upper edge of the symphysis pubis—4½ inches. Its greatest *transverse* measurement (*t t*) is 5¼ inches. In addition to these, there is also described an *oblique* diameter, extending from the sacro-iliac synchondrosis on either side to a point near the ilio-pectineal eminence on the other. This measures 5 inches, and it must be remembered that these diameters take their name "*right oblique*" (*r o*), or "*left oblique*" (*l o*), *according to the sacro-iliac synchondrosis from which they spring.*[1]

It will thus be observed that, in the skeleton, the transverse is the longest diameter of the three, but, when the soft parts are *in situ*, this is not the case, as the iliacus muscle overlaps the brim, so as to diminish the transverse while it scarcely encroaches upon the oblique diameter. The effect of this is that the oblique is *practically* the longest diameter, a fact which we find of great interest and importance when we study the relation of the diameters to the fœtal head.

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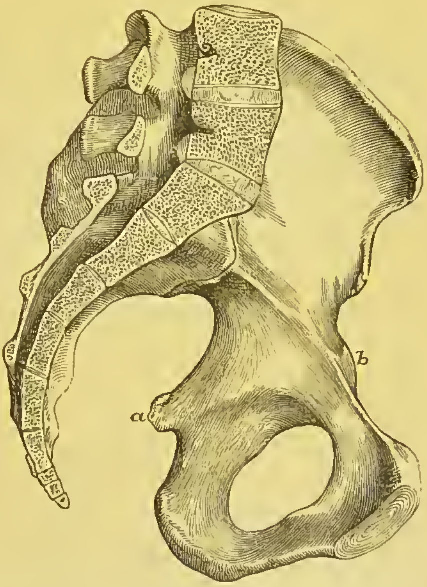
[1] In regard to this there unfortunately exists some confusion. The diameters are named *right* and *left*, as in the text, by most English and German writers, but French and American authors generally use the same words with reference to the cotyloid cavity in the neighbourhood of which each diameter terminates—thus inverting the meaning of the terms.

The Cavity of the pelvis is the whole tube between the brim and the outlet. As a general rule, the deeper the cavity the more difficult is the labour, for in this case the pelvis approximates in its conformation to the male type. If the diameters are proportionally enlarged, labour may be, it is true, quite easy; but the rule undoubtedly is that, in the case of the tall handsome woman with dignified gait and carriage, the probability of a difficult labour is much greater than in the short, wide-hipped woman, in whom the swinging, or (to put it less gallantly) the waddling motion of her sex is more obvious. The cavity, as a single glance will show (Fig. 15), is deep posteriorly and shallow anteriorly. The average depth of the symphysis pubis is about 1½ inches. The height of the planes of the ischia which corresponds to the middle depth may be stated as about 3½ inches. The depth posteriorly may be set down, if we measure directly from the promontory of the sacrum to the tip of the coccyx, as 4¼ inches, and, if we follow the curve of the sacrum, it may be increased to 5½ inches, the former of these measurements making no allowance, however, for the yielding of the coccyx. Three diameters are also taken in the case of the cavity: the *conjugate*, from the centre of the symphysis pubis to the upper margin of the third sacral vertebra, 5¼ inches; the *transverse*, from a point corresponding to the lower part of the anterior margin of the acetabulum on one side to a corresponding point on the other, 5 inches; and the *oblique*, from the centre of the great sacro-sciatic foramen on one side to the centre of the obturator membrane on the other, 5¼ inches.

Fig. 15.



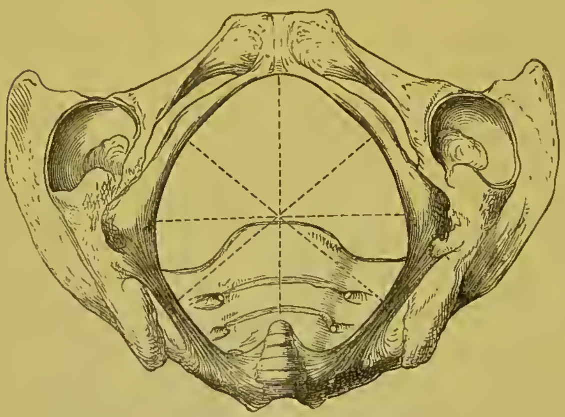
Interior of Pelvis, showing the Ischial Planes.

Looking now at the internal surface of the pelvic canal in a section such as is here shown, we may observe that the lateral wall is divided into two parts by a not very obvious line of demarcation (*a b*) leading downwards and backwards, from the ilio-pectineal eminence to the spine of the ischium. That part of the ischium which is in front of this looks slightly forwards, that which is behind slightly backwards. These are the *anterior* and *posterior inclined planes* of the ischium, supposed by Désormeaux, Tyler Smith, and many others, to determine the rotation of the head in the mechanism of parturition. To this, however, we shall return.

Outlet.—While the brim or inlet of the pelvis is directed, as we have seen, upwards and forwards in the erect posture, the outlet, owing to the curve formed by the axis of the cavity, looks backwards, and, when the coccyx is extended, almost directly downwards.

The *conjugate* diameter of the outlet (Fig. 16) extends from the lower margin of the symphysis pubis to the tip of the coccyx, and may be set down as 4½ inches. In many cases the measurement is much less than this, and in any case the diameter may be increased to the extent of an inch by the mobility of the coccyx during labour. The *transverse* diameter, from one tuber ischii to the other, is about 4¾ inches; and the *oblique*, from the middle of the lower edge of the great sacrosciatic ligament on one side to the point of union between the ischium and pubis on the other, also 4¾ inches.

Fig. 16.



Outlet of Female Pelvis.

Pelvic Diameters.—The facts which are brought out by those figures are chiefly these :—(*a*) that the transverse measurement of the pelvic tube becomes progressively diminished from above downwards, being greatest at the brim and smallest at the outlet: this is due, as a single glance downwards in the axis of the brim will show (Fig. 11), to the gradual approximation of the ischia: (*b*) that the conjugate diameter is, on the contrary, increased from above downwards, in consequence of the recession or curve of the sacrum, progressively from brim to outlet, if we allow for the bending back of the coccyx. These facts, which are associated with a remarkable rotation which the child undergoes during labour, are more clearly shown when, as in the following Table, the figures above noted are brought into juxtaposition. Along with these, a few of the more important of the many measurements which have been made of the female pelvis are also set down in inches, according to the average of the most recent and approved observations.

Measurements of the Female Pelvis.

1.	Circumferential measurement of the Brim,	17
2.	Between widest part of Iliac Crests,	10¾
3.	,, Anterior Superior Spines of Ilium,	10¼
4.	,, Front of Symphysis and Sacral Spines,	7

5. True Pelvis.	Conjugate.	Transverse.	Oblique.
Brim,	4½	5¼	5
Cavity,	5¼	5	[5¼][2]
Outlet,	4½[1]	4¾	[4¾]

[1] 5½ inches when coccyx forced back.

[2] The oblique diameters of the cavity and outlet are placed in brackets, as, not being taken from fixed bony points, they are of comparatively little importance.

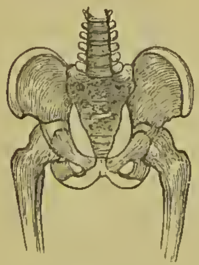
All the measurements given in this Table are, it must be remembered, those of the skeleton—no allowance being in any case made for the soft parts; and to them we may add another measurement, which has an important bearing on practical considerations arising from the study of a certain class of pelvic deformities. This is the *sacro-cotyloid diameter*, which is about 3½ inches in a well-formed pelvis, and is represented by a line drawn from the centre of the sacral promontory to the ilio-pectineal eminence. The encroachment of the psoas and iliacus muscles, with investing and other structures, reduces the transverse diameter of the brim by about half an inch, while the other diameters of the brim, as well as of the cavity and outlet, are only reduced by an eighth to a quarter of an inch at the most. The oblique diameters are least of all affected; but, owing to the presence of the rectum on the left side, the *left* oblique diameter is slightly shorter than the right. These facts have to be borne in mind in the course of examinations which are made with a view of estimating the capacity of the pelvis in its various parts,—a question often of vital import in the practice of midwifery; and in such investigations it is also useful to know that the distance from the *lower edge* of the symphysis to the promontory of the sacrum is about half an inch more than the conjugate of the brim. In regard to the measurements numbered 2, 3, and 4 in the Table, if these are to be estimated by measurements in the living body, from two to three inches must be added for the tegumentary and other external structures.

In addition to the angles which have already been described as formed with the horizon by the planes of the brim and outlet, and measuring respectively 60° and 11° (Fig. 13), and the sub-pubic angle, there are several others which should not be overlooked. *The sacro-vertebral angle* is that which the sacrum forms with the vertebral column, and is estimated as 117° in the male, and 130° in the female. The symphysis forms with the horizon an angle of 35° to 40° in the erect posture; while the ischium forms with the ilium, or rather with the imaginary line leading downwards and forwards, and representing the mean direction of that bone, an angle of 110° to 115°. This latter is called the *ilio-ischial angle.*[1]

Development of the Pelvis.—From birth to the age of puberty, the pelvis differs in many respects, besides mere size and state of ossification, from the same part in the adult. At birth, the iliac fossæ are flat, and have their surfaces directed more forwards. The symphysis is short. The sacrum is very narrow, and on this account the transverse measurements are relatively smaller than the conjugate; whilst all the diameters are extremely small, and so insufficient for the reception of what are known as pelvic organs, that these parts are for the most part lodged in the abdominal cavity. This contributes, no doubt, to the abdominal prominence which is so familiar in the newly born. The sacrum is very flat, and there is also very little approximation of the inner surfaces of the ischium, which gives to the sides of the pelvis a general appearance of parallelism not existing in the adult. A very general idea prevails among the best modern writers that the inclination of the brim is considerably increased as compared with the adult. This has been stated by Cruveilhier and Burns, and even more decidedly by Cazeaux. "The sacrum," says the latter, "is so flat and so elevated, that a horizontal line drawn from the upper part of the pubis will pass below the coccyx." Mr. Wood, however, has given the weight of his authority in favour of another view, and states it as the result of his careful observations, made by sections when the soft parts were *in situ,* that he has always found the tip of the coccyx "as low as the *lower* border of the symphysis pubis." Such a serious discrepancy can only be accounted for by supposing that a different mode of observation has been adopted.

The child, it must be remembered, is not as yet structurally fit for the erect position, and therefore maintains for many months after birth a posture similar to that which is assumed in the womb, with the thighs flexed upon the abdomen, and the symphysis tilted upwards. To measure the pelvic angles of the child, with the view of comparing them with those of the adult, it is essential that the child should be placed in such a position as may coincide as nearly as possible with the erect posture; and, if this be done, the pelvis will usually be

Fig. 17.



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[1] For a complete and exhaustive demonstration of these and other points alluded to, see Mr. Wood's Essay; Art. "Pelvis," in Todd's Cyclopædia.

found to present the appearance shown in Fig. 17. From this point of view, Cazeaux is possibly correct; but, if a section be made through a child in the position which it instinctively adopts, the relative position of parts, as described and figured by Mr. Wood, will probably under these circumstances be confirmed. The other distinctive characteristics of the infant pelvis are also shown in the figure, in which, moreover, the general resemblance to the type of the Simiadæ may afford some pleasing suggestions to the disciples of Darwin.

According to Burns, it is not until the tenth year that the transverse comes to exceed the conjugate measurement. There is, however, nothing which would enable us to distinguish with even an approach to certainty between the male and female pelvis until the period of puberty approaches, when nature, availing herself of the plastic condition of the bones, due to their tardy ossification, moulds the parts, in full view of the important physiological function which is about to be instituted, so that the marked characteristic features of the female pelvis are now rapidly developed.

Soft Structures and Floor of Pelvis.—Hitherto we have looked at the pelvis as an osseous and ligamentous structure. Connected in the most intimate manner with it, however, there are certain soft structures which cannot properly be included in a description of the organs of generation, and which fall therefore to be considered in this place. The fan-shaped *iliacus* muscle forms, along with the *psoas* on each side, a sort of cushion, which, besides giving proper support to other viscera, forms a rest for the gravid uterus and an effectual protection for it against shock. It encroaches, as we have seen, upon the transverse, without materially lessening the oblique diameter, and this encroachment is more marked when the muscles are in a state of contraction. On each side of the cavity, there are two muscles covering in to a large extent the great sciatic and obturator gaps. These are the *pyriformis* and *obturator internus* muscles, to the contraction of which the rotation of the fœtal head which takes place within the cavity was supposed by Flamand of Strassburg to be due. The dimensions of the cavity are further reduced by the rectum and bladder, and by the cellular tissue which, when overcharged with fat, may form a barrier to the progress of labour, rendering its course more tedious.

The perineal strait, open in the skeleton, is occupied by firm contractile tissues, which form a floor for the support of the pelvic, and, indirectly, of the abdominal viscera. This floor consists of two muscular layers. Of these, the internal layer, formed by the *levatores ani* and *coccygei*, has its concavity directed upwards, and has been named, not inappropriately, by Meyer, the "pelvic diaphragm." The external layer, with its concavity downwards, is formed of the muscles of the perineum, known to anatomists as the *sphincter ani, transversus perinei, ischio-cavernosus* and *sphincter vaginæ.* The pudic vessels and nerves, cellular tissue, the pelvic aponeurosis, an inter-muscular aponeurosis, and the skin, complete this floor, which at the time of delivery becomes thin and distended to a very remarkable extent. In the ordinary state, the measurement from the coccyx to the posterior commissure of the vulva is a little more than three inches ; but, during labour, the distention is such that it is increased to 5, 6, 6½ inches, or even more, by the stretching of the parts, and by the tonic contraction of the sphincter of the anus being overcome.

CHAPTER III.

FEMALE ORGANS OF GENERATION.

A. External. *Labia; Perineum; Hymen, &c.—Erectile Tissue.—The Vagina.—Glands of the External Organs.—Abnormal and Congenital Peculiarities.—Mammary Glands.*

B. Internal. *The Uterus; Situation; Division into Body and Cervix; Axis of Unimpregnated Uterus; Cavity; Fundus; Surfaces and Borders; Serous Covering; Broad Ligaments; Round Ligaments; Vesico-Uterine Folds.—The Fallopian Tubes—Parovarium—Folds of Douglas.—Equilibrium of the Uterus.*

The Organs of Generation in the female include—besides the Uterus, Ovaries, and other parts situated internally—the Vagina, Vulva, and Mons Veneris. These latter being, more properly, external, anatomists have divided the whole into External and Internal Organs.

Mons Veneris.—Immediately over the symphysis pubis, above and in front of the opening of the *vulva* or *pudendum*, is a firm cushion-like eminence, about two inches in depth and three inches transversely. This, which is called the mons veneris, is the first of the External Organs which falls to be noticed. This structure varies in prominence according to the conformation of the pubes, and the amount of adipose and cellular tissue in it and the contiguous parts. After puberty, it is covered with hair, and is abundantly furnished with sebaceous follicles, which were supposed by Moreau to contribute in some measure to the dilatation of the external parts at the moment of delivery.

Labia Majora.—Continuous with the above, extending downwards and backwards, and becoming gradually thinner in their course, are two rounded folds of integument, which, diverging from each other, leave in the median line an elliptical interval between them. These are the labia majora, labia externa, or labia pudendi. They present an external surface, covered with skin similar to that of the mons veneris, and an internal surface lined with mucous membrane, which is the commencement of the genito-urinary tract. Behind, the thinner margins unite, forming the posterior commissure of the vagina. The *fourchette*, or *frænulum pudendi*, is a transverse fold in front of this, which resembles and has been aptly compared to the fold of skin between the fingers, and is very generally torn in first labours. The depression between the fourchette and the commissure is named the *fossa navicularis*. Between the skin and superficial fascia of the labia there exists a purse-shaped sac, analogous to the dartos tunic of the scrotum. This sac is filled with fat and cellular tissue, is the receptacle occasionally of a hernia, and to it have been traced the terminal fibres of the round ligament of the uterus.

The Perineum extends from the posterior commissure to the anus, and is usually about an inch and a half in length. It is made up of highly elastic cellular tissue, and is, undoubtedly, susceptible of remarkable distension during labour, without, under ordinary circumstances, any risk of rupture.

Labia Minora.—On separating the labia majora, the labia minora or nymphæ are brought into view. These are two thick mucous folds, somewhat resembling the comb of a cock, about an inch and a half in length, having their origin on the inner surface of the labia majora, and becoming wider as they pass upwards and forwards, converging towards the clitoris, with the prepuce of which they are continuous. The *clitoris* is a small erectile tubercle, situated somewhat above the level of the lower margin of the symphysis pubis. Like the penis of the male, it has a suspensory ligament, two crura, two corpora cavernosa, and a glans, but has no corpus spongiosum nor urethra. Two muscles, corresponding to the ischio-cavernosus, are in the female called "erectores clitoridis." The *vestibule* is a small triangular space, bounded above by the clitoris, below by the urethra, and on either side by the diverging nymphæ. It is about an inch in length, is smooth on the surface, and is specially important as a guide to the finger of the accoucheur in the introduction of the catheter—an operation which should always be performed, if possible, without exposing the patient.

The Meatus Urinarius is indicated by a small projection, easily discovered by the finger, immediately beneath the vestibule, and in front of the vaginal entrance. The catheter being laid along the palmar surface of the forefinger, its point is guided towards the projection just mentioned, when, if the other extremity is gently depressed, it will usually pass in without the slightest difficulty. When the parts are distorted by disease, or by the tumefaction which occurs during or after labour, it is often necessary to expose the patient before the instrument can be introduced. The *urethra* is about an inch and a half in length, highly distensible, and, in the unimpregnated state, almost straight. In young children, what may be called the urinary parts of the vulva are prominent, and it is not till the approach of puberty that the genital portion is observed to predominate.

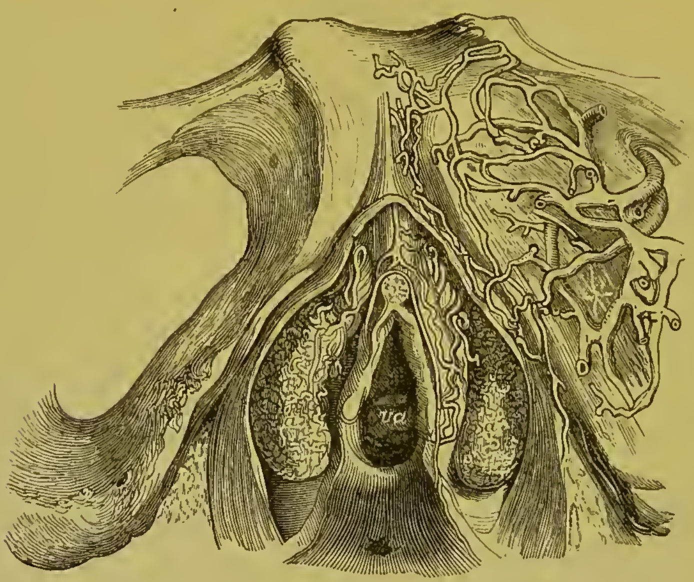
The Hymen.—Behind and beneath the meatus is the orifice of the Vagina, varying greatly in appearance and in dimension in young girls, in those who are no longer virgins, and in those who have borne children. In virgins, it is generally closed to a considerable extent by a thin fold of the mucous membrane called the *hymen*, which was at one time supposed to be the "seal of virginity," but which may be ruptured by many causes other than coitus. Its usual form is crescentic, with the concavity upwards, closing in the posterior, and to some extent the lateral portions of the opening; but it may present itself under various other forms. It has been frequently observed, for example, to be circular, with a small perforation in the centre; or cribriform, with several perforations, as in a medico-legal case which the writer was called upon to examine; or infundibuliform, or offering rarer peculiarities. In some instances, the closure is complete. But, whether complete or partial, or under whatsoever form it may present itself, the first effects of coitus are generally sufficient to rupture this fragile partition. In rare cases, however, its texture is so firm and resistant, that penetration is rendered impossible until the structure has been divided by the scalpel; and in cases of complete closure, where there is no question of coition, the operation may be necessitated from its being a barrier to the menstrual flow.

When the hymen is absent, small projections, called *carunculæ myrtiformes*, generally about three or four on each side, are noticed on the margins of the opening. These were generally supposed to be the remains of the ruptured hymen; but, as they have been found to exist along with the hymen, this must be looked upon as open to doubt.

Blood-vessels are supplied in abundance to all parts of the external generative organs, and in certain situations the masses of venous plexuses which are termed *erectile tissue* are found in considerable quantity. Fig. 18, from Kobelt, shows these structures carefully dissected. Besides the erectile parts already mentioned, there are, on either side of the vaginal orifice, two large leech-shaped masses, *a*, called *bulbi vestibuli*, which are about an inch in length, and are connected with the crura of the clitoris and the rami of the pubis, covered internally by the mucous membrane, and embraced on the outside by the fibres of the constrictor vaginæ muscle. A small plexus—the *pars* *intermedia* of Kobelt—has direct vascular connection with the bulbs. These erectile tissues receive their blood from the internal pudic arteries.

The Vagina (*va*) is a membranous and highly dilatable tube, which serves to connect the vulva with the uterus. It is situated in the true pelvis, between the bladder and rectum anteriorly and posteriorly, and the levatores ani muscles at the sides. Its axis is a curve, which corresponds in some degree to that of the pelvis, and, in consequence, its anterior is shorter than its posterior wall, the former being about four, and the latter five or six inches in length. It is narrowest at the vulva, where it is embraced by the constrictor vaginæ muscle, and widest at its middle part, where it is extended transversely, owing to its being compressed by the organs before and behind. The thickest part of the tube is its anterior wall, where it is intimately connected with the bladder, and with the urethra, which is, as it were, imbedded in it. Its connection with the levatores ani muscles and the rectum is much looser, which admits of easy dilatation, and this also accounts for the fact that the rectum is rarely dragged down in uterine displacements, while the bladder is, from its closer connection, invariably altered in its relations. In the upper part of the posterior surface, it is separated from the rectum by a double fold of serous membrane, which forms a pouch of the peritoneal cavity.

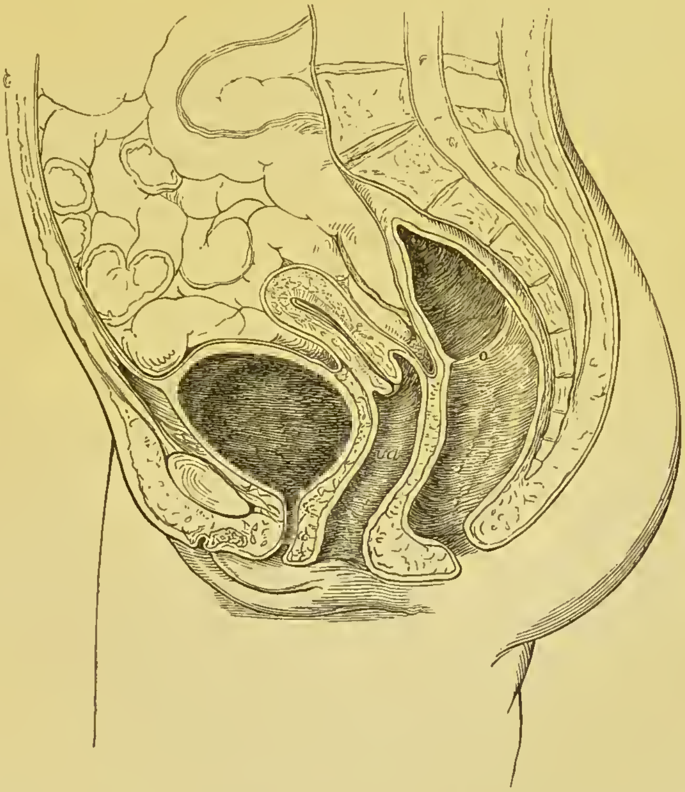
Fig. 18.



External Organs, partially dissected. (Kobelt.)

The external layer of the vagina is composed mainly of dense areolar tissue, beneath which there are two indistinct layers of muscular fibres of the unstriped variety, the external being disposed longitudinally, while the internal are circular in their direction. Around the tube, a layer of loose erectile tissue has been found, which is most distinct at the lower part. Internally, it is lined throughout by mucous membrane, which is covered with epithelium of the squamous variety, and is continuous in one direction with the skin and in the other with the mucous membrane of the uterus. Along the anterior and posterior walls, the membrane is slightly raised in the middle line, so as to form a ridge similar to the raphé in other parts. These ridges are called *columnæ rugarum;* and, at right angles to them, the membrane is thrown into numerous transverse folds (*rugæ*) which are always more distinct in those who have not borne children, and which are obviously destined to facilitate the dilatation of the parts.

Fig. 19.



Showing the relative position of the Pelvic Organs.

The upper part of the vagina embraces the neck of the uterus in such a manner that the vaginal mucous membrane is reflected over the neck of the uterus some way above its mouth, the point of reflection being higher on the posterior wall; and it has been observed that the connection between this membrane and the subjacent uterine tissue is very firm close to the mouth of the womb, and is much less so as it approaches the point of reflection. This admits of the complete dilatation of the uterus, and the consequent obliteration of the neck. The other tissues of the vagina are continuous, or at least very closely united, with the corresponding tissues of the uterus. A reference to Fig. 19 will serve to show that the vagina terminates in a cul-de-sac above and behind the uterus, and that at this point its wall is for some distance in direct relation with the peritoneal cavity, a fact of no little practical importance. The cul-de-sac of peritoneum with which it is in contact is termed the *recto-vaginal pouch*, and sometimes the *pouch of Douglas.*

Further, the vagina may be considered as the organ of copulation in women, and as the canal which is destined to transmit the menstrual discharge, as well as, in pregnancy, the product of conception. It is abundantly supplied with vessels and nerves. The blood supply is derived from the vaginal and other branches of the internal iliac artery, and returns by means of corresponding veins, after forming at each side a vaginal plexus. The nerves have been traced to two sources, the hypogastric plexus of the sympathetic system, and the fourth sacral and pudic nerves of the spinal system.

The external organs of generation are furnished with numerous glands of various kinds, which have been very fully described by MM. Robert and Huguier. The latter divides the glands of the vulva and entrance of the vagina into sebaceous and muciparous follicles. The *sebaceous* variety is met with in great abundance over the whole of the parts, from the genito-crural folds to the clitoris and nymphæ. Those of the nymphæ are exclusively sebaceous, and they all find their function in the secretion of an oily fluid, which maintains the elasticity, moisture, and sensibility of the parts, prevents them from adhering, and, above all, protects them from the irritating action of the urine. The *muciparous* follicles differ essentially in their situation, and in the nature of the fluid which they secrete. Although here and there they are isolated, as a general rule they are found in groups. One such group of eight or ten follicles is found imbedded in the mucous membrane of the vestibule. Another is observed in the immediate neighbourhood of the meatus urinarius, their orifices being extremely minute, and opening for the most part below the aperture of the meatus, upon, or close to, the little tubercle already described. A third group is described as external to these, and situated on either side of the urethra; and a fourth, the orifices of which have been observed on each side of the vaginal opening, at the root of the hymen or carunculæ myrtiformes.

Under the muciparous class, two compound or conglomerate glands were long ago described by Bertholin, and more recently by anatomists under the name of the *vulvo-vaginal glands.* They are also called the glands of Duverney, and are in many respects analogous to Cowper's glands in the male. They are about the size of a small bean, variable in form, and of a reddish yellow colour. Their development is said to proceed, *pari passu,* with that of the ovaries, reaching the maximum during the child-bearing period, and being comparatively insignificant in youth and old age. They are situated one on each side, at the entrance of the vagina, beneath the superficial fascia, with their inner surface united to the vagina by areolar tissue, and the outer surface in relation with the constrictor muscle of the vagina. Each of the lobes of which the gland is composed gives origin to a little duct, all of which conduits ultimately unite at the internal and upper part, to form a common excretory duct, which proceeds horizontally forwards as far as the vaginal orifice, where it terminates within the nymphæ, and external to the hymen or carunculæ myrtiformes. The orifice is very small and valvular, and is often only to be discovered with difficulty; but its situation is usually indicated by an increased vascularity at the point whence it emerges. These glands secrete a fluid (resembling that which is found in the prostate in the male) which is increased in quantity during coition, and is said to be expelled in jets, as occasionally occurs with the contents of the salivary duct. By lubricating the parts it facilitates coition, and by preserving their moisture probably tends to maintain their extreme sensibility.

Abnormal and Congenital Peculiarities.—The appearance and anatomical relations of the external organs of generation vary greatly according to age, and in consequence of venereal indulgence, or of child-bearing. At birth, the nymphæ project beyond the level of the labia majora, and the parts in general look more forward than in the adult. When puberty approaches, hair appears on the pubes, the nymphæ disappear between the labia, and the parts look downwards, so that, in the erect posture, nothing can be seen from before except the mons veneris; whereas, in the child, the upper parts of the vulva are distinctly visible. The labia are symmetrical, thicker above than below, closely applied to each other, and of a fresh rose colour on their mucous surfaces. Venereal indulgence, and still more, pregnancy and child-bearing, modify, in a great measure, the appearance here described. The hymen is ruptured and the carunculæ myrtiformes come into view. The labia lose their regularity, and become of a more dingy hue on their mucous surface. The nymphæ are again visible, partly by separation of the labia, and partly in consequence of hypertrophy of their tissue, while their vivid rose tint becomes replaced by a darker shade of colour. In some cases the hypertrophy is very remarkable, and is usually unequal on the two sides. This is said to be very common among Hottentot women, where the nymphæ often become enormously enlarged. In women who have borne children the fourchette is usually ruptured, and the vaginal orifice remains large and irregular. The vagina again, which in virgins presents the appearances already described, may now lose, to a great extent, its rugæ; and the deepening of its colour is by some supposed to be a not unimportant sign of pregnancy. In women of advanced age, the vagina becomes contracted, being again thrown into folds, and greatly diminished in caliber. Its orifice shares in the contraction, the nymphæ shrink, and the labia majora come once more into proximity, while the glandular, erectile, and other special tissues become atrophied. In a word, the characteristics of childhood are again partially restored.

Abnormal conditions, constituting some form or other of congenital malformation, are occasionally met with in the external organs. The labia may be imperfect or rudimentary, preserving in this respect the fœtal condition of the parts; they may be developed on one side only; or they may present the appearance of several folds. In cases of deficiency of the lower part of the abdominal wall and of the bladder, along with separation of the symphysis pubis, the labia are imperfectly formed and set wider apart than usual. The posterior commissure of the vaginal orifice may be hypertrophied and pushed forwards so as to cover the aperture. The labia are, in some instances, adherent along the median line, to such an extent that an opening is left, sufficient only for the passage of the urine. Induration and hypertrophy such as to constitute elephantiasis has also, although rarely, been noticed. Entire absence of the clitoris, unassociated with any other form of malformation, is very rare. It is sometimes so small that it can with difficulty be discovered, and in these cases it may be erroneously supposed to be absent; but it may be assumed that, unless other parts, such as the nymphæ, are absent, the clitoris is only rudimentary. This organ is much more frequently enlarged, generally, no doubt, as the result of disease, but sometimes it is a pure hypertrophy of the normal tissues, when it may approach the dimensions of the penis and constitute one of the forms of so-called hermaphroditism. An extreme development of the nymphæ—common, as we have seen, in certain races—may occasionally be met with as a peculiarity of structure; and cases are even recorded where they have been found increased to two or even three pairs.

The folds of which the hymen is composed, ordinarily thin and fragile, are occasionally developed to such an extent as to prevent sexual congress; while, in some cases, it completely closes the mouth of the vagina, preventing not only coition and impregnation, but also menstruation, and, for the latter reason, if not for the former, rendering an operation necessary. Another condition of these parts which may call for operative interference, is what has been called *vaginismus*, where there exists such spasmodic contraction as prevents proper sexual contact, dilatation with or without the use of the scalpel being in such cases often found necessary. Congenital absence of the vagina is by no means of very rare occurrence. In extreme cases, the whole organ is awanting—the vulva terminating abruptly at the point where the vagina, in the ordinary condition of parts commences. In others, a portion of the tube exists, but ends in a cul-de-sac at some distance from the os uteri; while, in another class, there is a narrow canal, sufficient only for the passage of the menstrual fluid. In many of these cases, free incision may be found necessary, in order, by giving egress to the menstrual discharge, to relieve the serious symptoms which arrest of that important function is apt to engender.

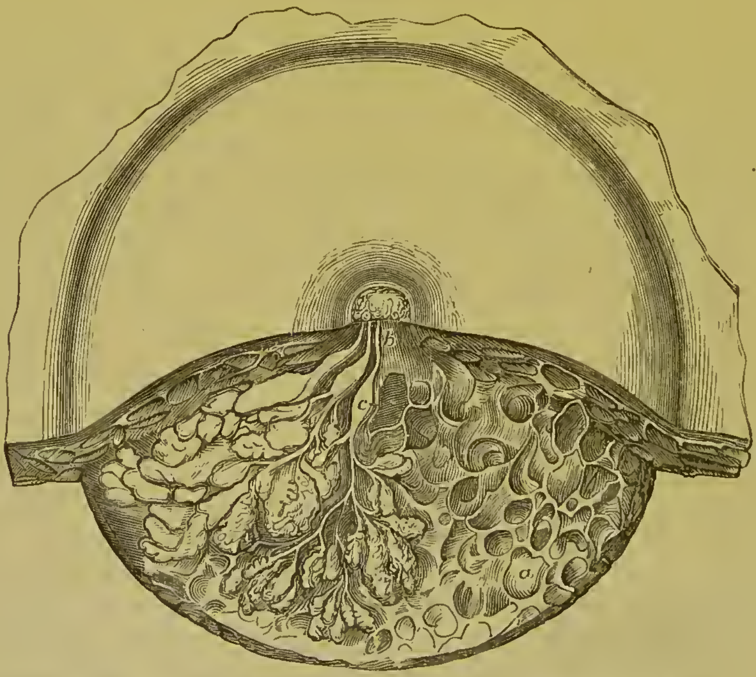
A vertical septum occasionally exists, constituting the phenomenon of double vagina, in which, if complete, there is a hymen to each tube. More frequently, however, the septum is incomplete—either commencing at the vulva and terminating so as to leave the tube single at its upper part, or, conversely, commencing at the upper part and stopping short of the mouth of the vagina. In the latter case, we would expect it to be associated with double uterus. Transverse membranous septa also exist as congenital malformations, but much more frequently as the result of inflammatory action, or of the accidents of previous labours.

Many of the conditions above detailed may give rise to serious impediments, either to delivery, to impregnation, or to the proper performance of the menstrual function, and, in consequence, delicate, and even dangerous operations may, under such circumstances, be required.

Mammary Glands.—Intimately associated with the function of the reproductive system, are the glands, the presence of which serves to distinguish the class Mammalia. On this account, several modern writers have, with perfect propriety, included these organs in a description of the external parts of generation. When they are fully developed in a woman, they extend from the third to the sixth or seventh rib, and from the side of the sternum to the axilla, the left breast being generally the larger of the two. The nipple (*mamilla*) projects about the level of the fourth intercostal space from near the centre of the gland, and is, in the virgin, of a rose pink colour. It is surrounded by a ring of similar hue (*areola*) varying in tint with the complexion of the individual. On the surface of this, several small tubercular projections are visible, on each of which are the orifices of several glands.[1] The tissue of the nipple is very rich in blood-vessels, and contains muscular fibres of the non-striated variety with a certain amount of erectile tissue, the surface being covered with papillæ, which are highly sensitive. The turgescence of the nipple, which occurs under irritation, is usually attended with a pleasurable sensation.

The bulk of the breasts, and what gives to them their smooth and moulded form, is chiefly fat, which, except at the nipple and areola, where the gland is contiguous to the surface, lies beneath the skin, and dips down into the intervals between the lobes and lobules of which the gland is composed. Each of these lobes is enclosed in a distinct cavity or *loculus* (Fig. 20, *a*), has a separate excretory duct, and is subdivided again and again into smaller lobes, and ultimately into terminal lobules.

Fig. 20.



Dissection of the lower half of the Female Mamma during the period of Lactation. (Luschka.)

Within the latter, by a process of cell development, and multiplication of nuclei, the milk is eliminated from the surrounding vessels. The fluid, on the rupture of the cells, passes into the terminal ramifications of the ducts, which by their junction form larger canals termed *galactophorous ducts.* The milk being thus brought from the various lobes, these ducts, from fifteen to twenty in number, converge towards the areola, beneath which they become considerably dilated into sinuses, *c*, which serve as temporary reservoirs for the milk. Between this and the nipple, the ducts again become contracted, *b*, and proceed from the base of the nipple towards its summit without communicating, each discharging its contents by a special orifice. The walls of the tubes and sinuses are composed of areolar tissue, with longitudinal and circular elastic filaments. Irritation of the nipple, whether by contact of the child's mouth or otherwise, causes a relaxation of the orifices, and at the same time, contraction of the walls of the sinuses, causing the milk to flow abundantly. Not unfrequently, a spasmodic contraction takes place independently of any special excitement, the result being the involuntary expulsion and loss of the milk. The well-known sympathy which subsists between the glands and other organs, such as the stomach and uterus, may give rise to similar phenomena; while that which exists between the breasts of each side often results in the spasmodic emptying of one gland while the child is at the other.

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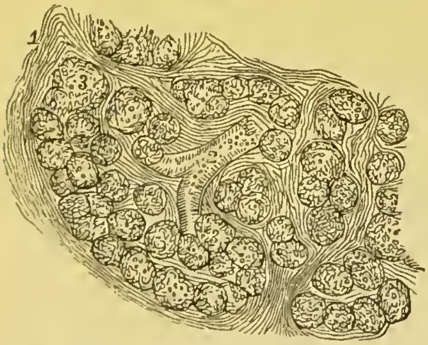
[1] These appearances are materially altered after impregnation. See *Signs of Pregnancy*, Chap. viii.

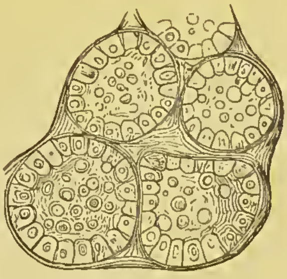
The lacteal vessels are lined throughout by a mucous membrane, continuous at the nipple with the common integument, and which is invested by a tessellated epithelium. They are accompanied in their whole course by numerous lymphatics, which are connected intimately with those of the axilla and other neighbouring parts. These lymphatics are believed to take up the watery portion of the milk, and it is supposed to be by their action that frictions are beneficial in cases where we wish to diminish or arrest the secretion of milk. They receive their blood from the internal mammary, axillary, and intercostal arteries. The veins form round the nipple a circle or plexus, which is usually

Fig. 21.



Structure of a Lobule of the Mammary Gland.

Fig. 22.



Ultimate Glandular Vesicles of the Mamma.

called the *circulus venosus* of Haller. In the latter months of pregnancy, the pressure of the gravid uterus tends, as Mr. Nunn has pointed out, to increase, from mechanical causes, the quantity of blood in those vessels, and thus to promote the secretion of the gland.

Fig. 21, from Henle, represents a section from a small lobule of the gland, magnified 60 diameters: 1, shows the stroma of the connective tissue which supports the glandular structure; 2, terminal ramuscule of one of the gland tubes; 3, glandular vesicles. Fig. 22 shows several of the glandular vesicles, magnified much more highly, about 200 diameters. The secreting epithelial cells which line the vesicles are here represented, while the cavities contain a certain number of milk globules.

In the male, the mammary gland exists, but is rudimentary. Various anomalies in structure have been met with, such as two or three nipples on one gland, or an additional mamma or even mammæ. In the latter case, the supernumerary glands are usually near their ordinary site, but sometimes they have been found on a distant part of the body—as the axilla, thigh, or back.

The Uterus, the Fallopian Tubes, and the Ovaries, form, with various ligamentous and other structures intimately connected with them, the Internal Organs of Generation.

The Uterus, when unimpregnated, and at mature age, is situated deeply within the true pelvis, between the bladder and the rectum in front and behind, and intimately connected at its lower part, as we have already seen, with the vaginal wall. The function which it has to discharge is to receive the product of conception, after it has passed through the Fallopian tube, and to maintain it within its cavity until, at maturity, it is expelled. The usual comparison of it to a pear, flattened from before backwards, gives one a very correct idea of its form. It is a hollow organ, with remarkably thick walls; and is so placed in the centre of the pelvis, that its upper part looks upwards and forwards, and its lower or vaginal part downwards and backwards. It is generally assumed, as sufficiently correct for all practical purposes, although by no means absolutely accurate, that its axis corresponds with that of the pelvic brim, or, in other words, that its axis, if carried downwards, would pass at the same time backwards, and, in the erect posture, meet the horizon at an angle of 30°.

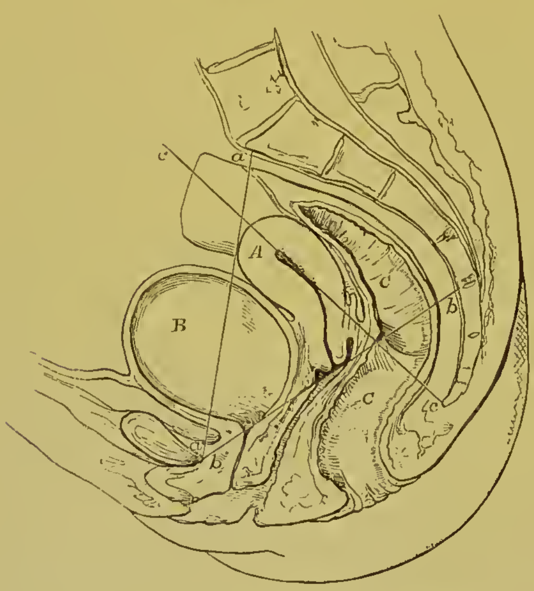
The uterus is divided into two parts; the *body* superiorly, and the *neck* inferiorly, the point of division between these two parts being frequently indicated externally by a slight constriction.

Till about the fourteenth or fifteenth year, this organ is of small size, but a considerable increase takes place at the period of puberty. In women who have borne children, its volume is permanently increased, although it is sometimes found in advanced age to have resumed in some measure the appearance presented in early life. It is temporarily increased in size during a menstrual period; but, if examined during the interval, the virgin uterus will be found to weigh on an average about 500 grains, and to measure, in length three inches, in breadth about two inches, and in thickness (*i.e.*, from before backwards) one inch. Its situation varies according to age. In the fœtus it is altogether above the brim, but from this position it gradually descends after birth, although it is not till the tenth year or even later that the fundus falls to the level of the brim plane. The uterus is, when healthy and normal, united with the surrounding parts by means of certain structures to be described presently. The nature of this union is essentially lax, admitting of pretty free movement in all directions, which may easily be tested by the finger, and which enables it to accommodate its position according to the degree of distension of the neighbouring hollow viscera. This laxity admits too of the free expansion of the uterus during the course of pregnancy, but unfortunately it may also give rise to certain displacements, which will be duly considered in the proper place, in so far as these have a bearing upon the practice of midwifery.

The Axis of the virgin uterus must, therefore, be constantly changing, now backwards and now forwards, according as vesical or rectal distension prevails. It is thus a matter of no little difficulty to determine what may be regarded as the normal axis of the uterus, and in all attempts which have been made by anatomists with this view, it has been usual to consider the parts to be in their normal relative position when the bladder and rectum are each moderately distended. The opinion which is usually adopted, and which is founded on estimates of this nature, is, as has been said, that the axis of the uterus may, in general terms, be described as identical with that of the pelvic brim. It is admitted that, in many cases, and especially in those in which the vagina is very short, the fundus falls more or less backwards so as to bring the uterine axis more into a line with that of the vagina, while, in some cases, the uterus is curved so that the body forms an angle with the neck.

This bending of the uterine axis, indeed, instead of being admitted as an exception, is recognised by many of the best authorities as the normal position of the womb, a view which careful personal observation leads us to confirm. It is a point of great importance, in making examinations on the living subject, that it should be clearly recognised that the finger, on a digital examination, approaches the os uteri in a direction corresponding to the axis of the vagina, which frequently forms nearly a right angle with the uterus. If this be overlooked, error is sure to creep into our calculations, as has evidently been the case in certain instances of inaccurate description of the anatomical relations of the womb. The opinion here expressed as to the position of the womb is in accordance with that of Kohlrausch, as shown in his plates, and is confirmed by Dr. A. Farre in his admirable essay in the Cyclopædia of Anatomy and Physiology, from which the diagram (Fig. 23) is taken. According to those able observers, when the bladder B and the rectum C are moderately distended, the fundus of the uterus is directed upwards and forwards, and the neck downwards and very slightly backwards towards the orifice of the rectum. The relative heights of these parts are determined, it is assumed, by two lines: the one, *a—a*, being drawn from the lower border of the symphysis pubis to the promontory of the sacrum, to mark the height of the fundus; and the other, *b—b*, carried from the same point anteriorly to the lower margin of the fourth sacral vertebra behind, to mark the plane of the orifice of the uterus. The line *c—c* indicates the axis of the body of the uterus. The representation, therefore, given in Fig. 23, is, as regards the position of the womb, probably nearly correct, subject, of course, to numerous modifications, in consequence of its mobility, and the influence exercised upon it by neighbouring organs.

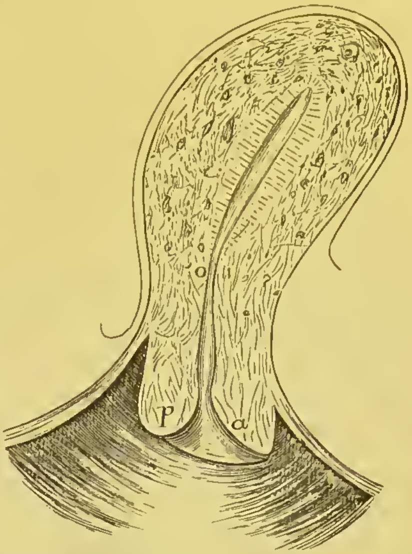
Fig. 23.



Diagram, showing relative position of Pelvic Viscera. (A. Farre.)

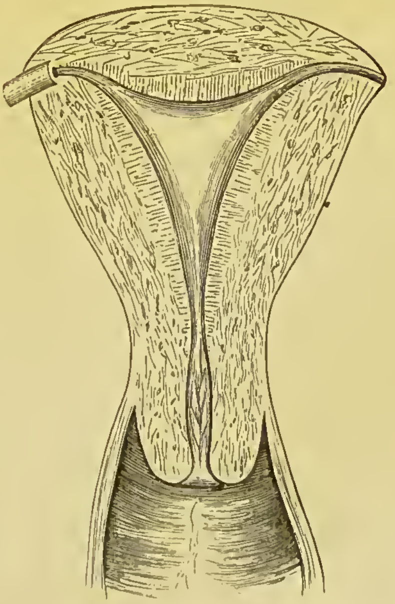
The interior of the uterus corresponds in some measure with its external surface. It is divided into two parts by a constriction not far below its middle, indicating the point at which the cavity of the cervix ends, and that of the body begins. This constriction, which is the usual cause of the difficulty experienced in passing the instrument known as the uterine sound, is called the *os uteri internum*, the orifice communicating with the vagina being named the *os tincæ*, *os externum*, or, more generally, the *os uteri*. In a profile section (Fig. 24), the anterior and posterior walls are shown to be almost in apposition, this being however, more complete at the internal os, *o*. From this point the cavity of the body extends upwards to the fundus, while that of the cervix reaches downwards, and terminates at the external os. The neck of the uterus is divided, as will be observed, into two portions, upper and lower, by the point of reflection of the vaginal mucous membrane, the lower part being called the vaginal part of the cervix. Viewed thus, the os is composed, as may be noticed, of two lips, *a*, anterior, and *p*, posterior, of which the former is generally described as the longer. This, however, which is more apparent than real, is caused by the position of the uterus as regards the pelvis, which brings the anterior lip lower in the vagina, and thus makes it seem longer than it really is in reference to the long axis of the organ. The vagina reaches somewhat higher on the posterior than it does on the anterior lip.

Fig. 24.



Profile Section of the Uterus.

Fig. 25.

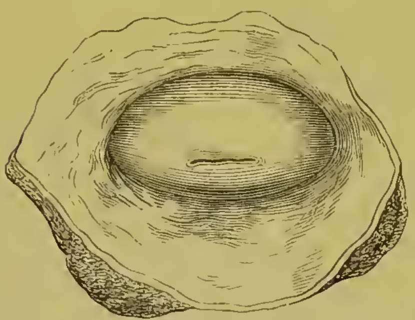


Transverse Section of the Uterus.

If we now make a transverse section as shown in the accompanying diagram (Fig. 25), it is to be noticed, in the first place, that the cavity of the cervix, as well as that of the body, is expanded from side to side, owing to the approximation of the anterior and posterior walls as indicated in the previous figure. The cavity of the cervix then is, being somewhat flattened from before backward, irregularly fusiform. Its lining membrane presents a peculiar appearance, being thrown into irregular folds, which branch laterally from a raphé or median line, in a direction generally upwards. This arborescent appearance has given rise to the name under which it is known to anatomists, the *arbor vitæ uterinus*, and it has been observed that, in the uteri of very young children, these folds are traced much higher than in the internal os, which is their limit in the adult. The cavity of the body is from this point of view triangular in shape, smooth on its surface, and having three openings leading into it, one at the internal os or apex of the triangle, and one at each upper angle, leading right and left into the Fallopian tubes. Some rare instances of congenital absence of the cavity have been recorded: what is more common is adhesion of the walls in old age.

The Os Uteri, as felt by the finger, or as seen through the speculum, is a transverse opening or slit, which in the virgin, and in the absence of structural disease, is perfectly smooth. In these circumstances, the aperture is closed, but the depression between the lips is easily felt, and is precisely similar, in the impression it communicates to the finger, to the sensation experienced when the finger is applied to the tip of the nose. In this case the cartilages represent the firm tissue of the lips, while the vertical interval between them corresponds to the transverse slit which constitutes the os.

Fig. 26.



Os Uteri.

The characteristics above described are those of the virgin, or, as Dr. Tyler Smith more correctly calls it, the "nulliparous" uterus. During pregnancy, the organ is enormously distended, and the anatomical relations of the contiguous parts are greatly disturbed. After delivery, the parts contract, and regain in a great measure their original appearance and condition, but they nevertheless retain features of dissimilarity, which enable the observer, on a careful examination, to distinguish the uterus of a woman who has been a mother. The chief points of distinction are as follows:—The weight of the organ is increased, according to Meckel, to about an ounce and a half; the fundus and body are rounded externally; the cavity of the body loses its triangular shape, and becomes much larger relatively to the cervix, the os internum being agape. The arborescent folds of the cervix are in a great measure obliterated, or at least are rendered indistinct, and the os externum is patent. The differences in the latter are, from the fact of its being of easy access to the finger, of special importance, and consist mainly in an enlargement of the parts, and an irregularity in the surface of the lips, which are now no longer smooth, but puckered round the edge of the os, and often nodulated on the surface. These irregularities are due to slight lacerations of tissue which occur during delivery. They are always more marked in women who have borne many children, where the lips are not unfrequently divided into lobes by shallow furrows, representing these lacerations, and which radiate from the os as from a centre. These fissures are generally observed at the sides or angles of the os, and are, according to Cazeaux, much more marked on the left than on the right side. When extreme they constitute the condition known to gynæcologists as "split cervix," an affection which is sometimes rectified by operation.

The uterus, then, as may be inferred from what has been said, presents a fundus, more or less rounded according as the woman has or has not borne children, two borders laterally, and an anterior and posterior surface, of which the latter is the more convex. It consists of three constituent layers: a serous or investing coat; a mucous or lining coat; and an intermediate thick layer of fibro-muscular structure constituting the proper tissue of the uterus. Each of these requires special and very careful consideration.

Ligaments of the Uterus.—The great serous membrane, which invests almost the whole of the abdominal viscera, is also reflected over the greater part of the womb, constituting what has been described as its *Serous Coat*, while it forms the most intimate anatomical relations with the structures which have for their object the suspension or support of the womb. Passing backwards over the fundus of the bladder, the peritoneum becomes reflected upwards on the anterior surface of the uterus, from a point which, in the virgin state is about midway between the os externum and internum, a space being thus left (see Fig. 19) through which direct communication may take place between the uterus and the bladder. This may occur as an accident in midwifery practice, constituting a vesico-uterine fistula, as in a case reported by the writer.[1] From the front to the back of the uterus, the membrane now passes over the fundus, and investing the whole of the posterior surface with the exception of the vaginal portion, reaches downwards behind the vagina, in the manner already described, to form the pouch of Douglas. The manner in which the uterus is thus embraced by the peritoneum in its course from before backwards is peculiar. Instead of investing the lateral parts of the organ in the same manner as the anterior and posterior walls, it is stretched from side to side of the pelvis, forming, in fact, a double layer of peritoneum, in the centre of which the uterus is confined. These folds, intimately connected on either side with important organs to be presently described, are the *broad ligaments* of the uterus.

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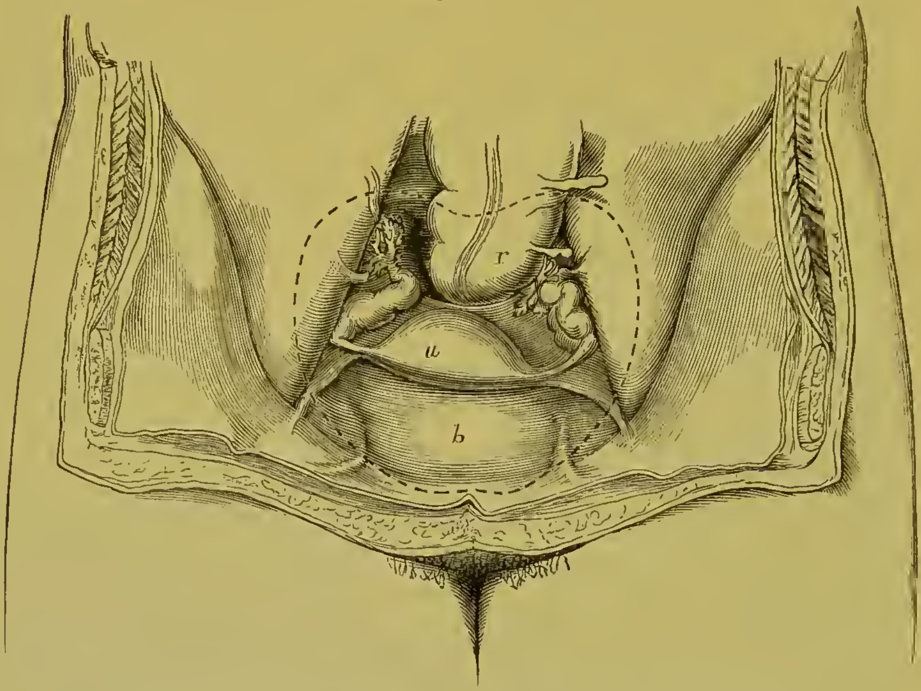
[1] Glasgow Medical Journal, 1862.

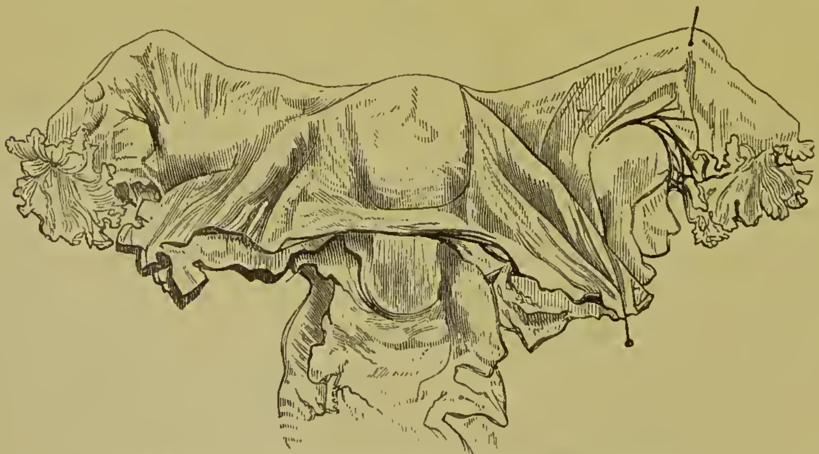
Fig. 27.



Pelvic Organs *in situ*, viewed in the Axis of the Brim. (After Schultze.)

Looking from above downwards (Fig. 27) in the axis of the brim, it will be noticed that the broad ligaments, with the uterus *u*, form a partition or curtain, dividing the cavity of the pelvis into two parts, anterior and posterior, of which the anterior is occupied mainly by the

Fig. 28.

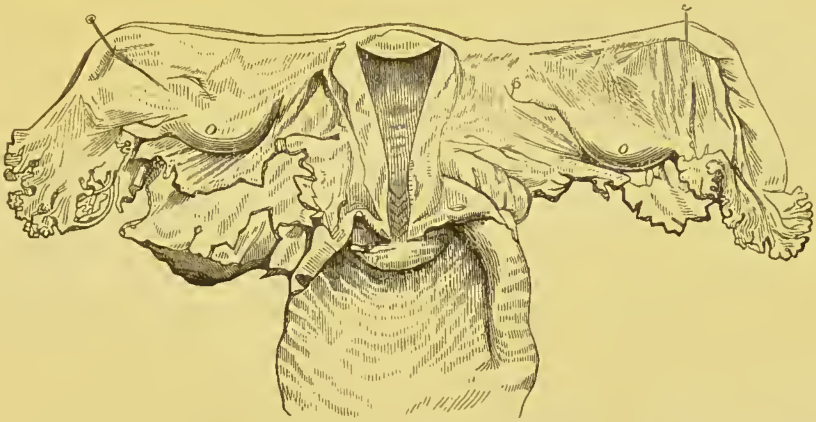


Anterior View of the Uterus and its Appendages. (Quain.)

bladder, *b*, and the pouch which separates it from the womb, while the posterior contains the rectum, *r*, and the pouch of Douglas. It will also be observed that the greater convexity, and, indeed, the bulk of the uterus, projects into the posterior of the two cavities. The attachment of the broad ligament is in point of fact to the anterior lip of the lateral border of the womb.

If, therefore, the uterus and the broad ligament are viewed from before, as in Fig. 28, the fundus and body of the uterus are indeed indicated, as well as the situation of other parts to be mentioned immediately, and the relation which they all bear to the vagina; but the parts themselves are only to be distinctly demonstrated by turning our attention to the posterior surface of the pelvic partition, as shown in Fig. 29, where the posterior wall of the uterus has been removed, in order to show the interior of the organ. The peculiar structure of the cavity of the cervix, the anterior lip of the os, and the anterior wall of the vagina are also shown, as also the triangular space bounded inferiorly by the ovary and its ligaments which, from a fanciful resemblance to a bat's wing, has been called *ala vespertilionis*.

Fig. 29.



Posterior View of the Uterus and its Appendages. (Quain.)

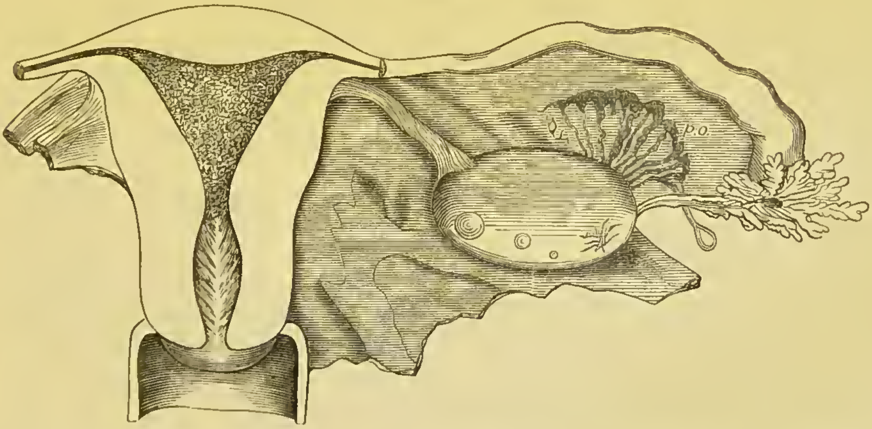
It is thus very apparent that the effect of the broad ligament is to maintain the uterus in its central position as regards the pelvic cavity, and to prevent its displacement downwards, while it admits of free antero-posterior movement of the fundus, corresponding to the distension of the bladder or rectum.

Between the two layers which constitute the broad ligament, and each occupying a fold more or less distinct, are the following structures: the *round ligament* (see Fig. 27), a cord-like bundle of fibres, partly muscular, and about four and a half to five inches in length, which has its course on each side from the angle of the uterus, first upwards and outwards, and then forwards and a little inwards to the internal inguinal ring. Passing, like the spermatic cord in the male, through the inguinal canal, and invested by a peritoneal sheath called the canal of Nuck, its fibres expand and are lost in the mons veneris, some of them having been traced to the purse-shaped cavity in the labia majora already described. According to Madame Boivin, the ligament of the right side is a little shorter and thicker than the other. Two small semi-lunar folds are seen on this aspect, which are formed by the peritoneum in its passage from the uterus to the bladder, and which limit laterally the pouch existing between these two organs. They are called the *vesico-uterine* ligaments. The uterus is generally observed to be a little more to the right than to the left side; and it is asserted by Schultze that in the normal position it is somewhat twisted on its axis so as to turn the anterior surface a little to the right. On this observation is grounded a theory which Schultze has propounded as to the position of the child in the womb. All this is shown in Fig. 27.

Fallopian Tubes.—Reverting now to the posterior surface of the broad ligament, we find several parts which are of the highest physiological importance. At the upper or free margin of the broad ligaments, and occupying a portion of the space between its layers, there extends from each angle of the uterus a thick cord, between three and four inches in length, at first nearly straight in its direction, but in its outer half pursuing a somewhat tortuous course, especially in young subjects. This is found, on dissection, to be traversed in its whole extent by a canal of small diameter (*oviduct*), which is more familiarly known to anatomists under the above name. It is composed in a great measure of muscular tissue, which is disposed in layers, an external one of longitudinal, and an internal of circular fibres. Along with this is areolar tissue, the whole being embraced by the peritoneum in the manner described. The canal is lined with mucous membrane, with an epithelium of the columnar and ciliated variety, continuous at one extremity with the mucous membrane of the uterus, and at the other with the inner surface of the peritoneum—a unique example of a mucous being continuous with a serous membrane, and of a serous cavity which is not absolutely a closed sac. The tube is small, and its cavity narrow at the uterine end, barely permitting the passage of an ordinary bristle, but it becomes dilated in its course outwards, and ultimately expands into the trumpet-shaped extremity from which it derives its name (*tuba*). The mucous membrane lining the canal is disposed in longitudinal folds, so that, in a transverse section of the structure, the cavity presents a stellated appearance. The mouth of the tube has a very irregular and fringed margin, hence its name of *fimbriated* *extremity*—the fimbriæ being arranged in a circular manner, and surrounding the orifice, which looks downwards in the direction of the ovary. With this organ it is in fact connected by an elongation of one of the fimbriæ, and it is to be noticed that the ciliated epithelium is prolonged beyond the tube, especially on the inner surface of the fimbria here described. It was long believed that, when the ovum comes to maturity within the ovary, that portion of the organ from which it is about to escape by dehiscence is firmly grasped by the whole of the fimbriæ, so as to prevent effectually the escape of the ovum into the abdominal cavity. This was called by the older writers the *morsus diaboli.* It is now known, however, that, although the congested fimbriæ may overhang the ovary, no such grasping takes place, but that the ovum makes its way to the orifice of the tube by other agencies, which will be further described hereafter, and is by it conducted to the uterus, where it is retained and developed, or whence it is discharged, according to circumstances.

Leading from the inner extremity of the ovary—an organ to be hereafter described—is a dense cord, composed mainly of fibro-areolar tissue, but containing also muscular fibres. This is the *ligament of the ovary,* which is also, like the round ligament and the Fallopian tube, firmly united to the angle of the uterus at a point behind and below the latter, and is about an inch and a half in length.

Fig. 30.



Diagrammatic View of the Uterus and its Appendages as seen from behind. (Quain.)

The Parovarium or Organ of Rosenmüller (Fig. 30, *p o*), is situated between the layers of the broad ligament, and can usually be brought into view by holding up to the light that portion of the ligament which is between the outer part of the ovary and the Fallopian tube. According to the observations of Kobelt and Follin, the parovarium is usually composed of from seven to ten tubules, each of which is convoluted and ends in a cul-de-sac, while all converge towards the tube through which the vessels of the ovary pass. These tubes exist at all ages, but are more distinct in children, and still more so in the fœtus. In no instance have they been found to have an orifice, but their seems good reason to believe that they correspond to the epididymis of the male, more especially the coni vasculosi, and are therefore the vestiges of the upper part of the Wolffian bodies of the embryo. It is generally believed that the cysts which so frequently originate in this situation, have some anatomical connection with the parovarium. From the back of the uterus on each side, crescentic folds of peritoneum pass backwards towards the rectum (Fig. 27). They are more marked than the vesico-uterine folds, previously described, and are called the *posterior* or *recto-uterine* ligaments, or folds of Douglas, as they mark the upper boundary of the pouch with which the name of this anatomist is associated.

That muscular fibres exist between the layers of the broad ligament is a question no longer open to doubt; and there seems good reason to believe, from the researches of Rouget and others, that this is only a portion of a continuous envelope of muscular fibres, embracing the uterus, Fallopian tubes, and ovaries. These fibres are believed to exercise an important physiological function, in bringing all the structures into harmonious action at the time of the reception and descent of the ovum.

The uterus is thus—by means of its ligaments and other auxiliary structures—so suspended in the cavity of the true pelvis as to admit of tolerably free movement, and, at the same time, to restrict its mobility within certain limits. The movement of the body from side to side is curtailed effectively, in a healthy state of the parts, by the broad ligament, while displacement backwards is prevented by the vesico-uterine folds and the round ligaments, and movement in the contrary direction by the recto-uterine ligaments. Undue importance must not, however, be attached to the functions of these structures as ligaments; for it is very obvious that other parts (and in an especial degree the vagina) aid them in holding the uterus thus in suspension. The general laxity of all these tissues, however, which nature permits in view of the higher function of the uterus, is very apt, under disturbing influences, to give rise to displacements which have already been referred to, but the consideration of which belongs more properly to the department of gynæcology. It may, however, be observed that the symptoms of these displacements are, in a great measure, mechanical, and the direct result of the loss of equilibrium—as those, for example, which arise from pressure on the bladder or rectum, and the pain in the groin frequently experienced in retroversion, which is assumed by Cazeaux to arise from tension of the round ligament.

In the interval between the two layers of the broad ligament, and associated with the other structures above described, there is found a limited quantity of loose and extensible cellular tissue. This admits of the complete alteration in the anatomical relations of the parts which occurs during pregnancy, and this is further provided for by the manner in which the uterus is attached to its serous investment. The nature of the connection is firm at the fundus, and lax at the sides, where the peritoneum may be moved by the finger to and fro upon the subjacent tissue of the organ. The manner in which the neighbouring parts accommodate themselves to the distension of the womb during pregnancy will fall to be considered in a subsequent chapter.

CHAPTER IV.

FEMALE ORGANS OF GENERATION (Continued).

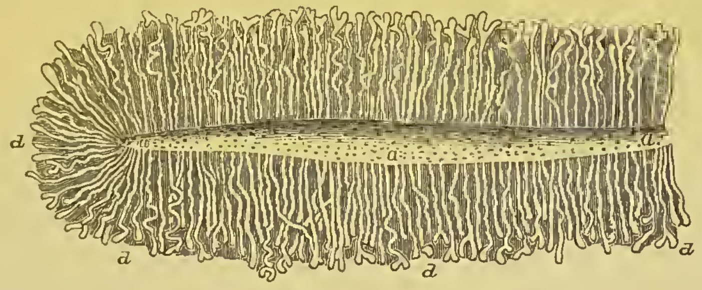
The Proper Tissue of the Uterus.—The Mucous Layer: its Structure and Glands; in the Body and Cervix.—Blood-vessels of the Uterus.—Lymphatics and Nerves.—Malformations and Abnormal Conditions.—The Ovaries: their Structure.—The Graafian Vesicles and their development.—The Ovum.—Phenomena of Ovulation.—Formation of the Corpus Luteum.—The Corpus Luteum of Pregnancy distinguished.

The Tissue Proper of the Uterus, which lies immediately beneath the peritoneum, and which constitutes the greater part of the walls of the organ, is very dense in structure, and, except during pregnancy or a menstrual period, is of a greyish colour in section, and displays numerous blood-vessels, some of them of considerable size. It is thickest at the middle of the body and at the fundus, thinnest at the Fallopian tubes, and is composed throughout of bundles of muscular fibres of the plain variety. These fibres in the unimpregnated condition are interlaced, disposed very irregularly in bands and layers, and mixed with fibro-areolar tissue, which is more abundant near the external surface. As in the case of other hollow viscera, the muscular elements may be described as consisting of an external layer, the fibres of which have a general longitudinal direction, and of an internal or circular layer. From the irregular manner, however, in which, in the unimpregnated uterus, the bundles of fibres are disposed, and the intimate union which subsists between them, this seems on the first glance to be somewhat of a forced analogy. And it would probably remain so, were it not that during pregnancy the stratification of the muscular tissue becomes much more distinct, so as to render the comparison quite justifiable, a fact which will be brought out more clearly afterwards. Anatomists usually divide this tissue into three layers, external, intermediate, and internal.

Mucous Membrane of Uterus.—The very existence of this membrane was long disputed, the obvious reason being that it differs so much from other mucous membranes, that physiologists, with some show of reason, refused to admit the analogy. More modern and more exact observations, however, leave no doubt as to the propriety of classifying it as it is here named. The descriptions usually given of the membrane by anatomists are very meagre, and in some respects inaccurate, which may serve as our warrant for examining its structure and functions a little more in detail than under other circumstances might have been necessary. It is the thickest mucous membrane in the body, constituting, in the cavity, about one fourth of the entire thickness of the organ. In this situation, it is of a reddish tint, but in the cervix, where it is much thinner, it is paler in colour, the thinning occurring somewhat abruptly at the os internum. It is firmly adherent to the subjacent muscular tissues, and cannot, in consequence of the sparseness of the submucous cellular tissue, be made to glide upon the part which it covers.

Tubular Glands.—The surface of the membrane is smooth, and abundantly studded over with minute dots, which are found on closer examination to be the orifices of numerous tubular or utricular glands, which run through the entire thickness of the membrane in a direction perpendicular to its surface. Fig. 31 represents a part of the cavity of the uterus showing the orifices of the glands (*a*), and, in section, the glands themselves (*d*.) They were believed by Weber to be, at the commencement of pregnancy, greatly convoluted, and sometimes bifurcated at the extremities, as here represented. The more recent and exact observations of M. Robin show, however, that when *in situ*, they are rather undulated than convoluted, that they are never spiral, although, as in Fig. 32, they may appear so when separated, and that they never bifurcate. During pregnancy and menstruation, they become greatly enlarged, and sometimes cross each other, an appearance which in all probability has led to the idea of a division of the tube. They are

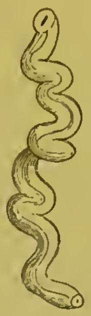
Fig. 31.



Tubular Glands of Uterus. (E. H. Weber.)

simple tubular glands, parallel to each other, ending in a cul-de-sac, and penetrating the entire thickness of membrane. They are lined by nucleated ovoid epithelial cells, their walls being finely granular, and very firmly adherent to the tissue which intervenes between them. Their length measures exactly the thickness of the mucous membrane, and is much less, therefore, where the membrane becomes thinner, on its approach to the os internum and the orifice of the Fallopian tubes. "If we except that of the stomach," says M. Robin,[1] "there is no mucous membrane more rich in glandular follicles than that of the uterus." In the pig and some other animals the epithelial cells which line the glands are ciliated.

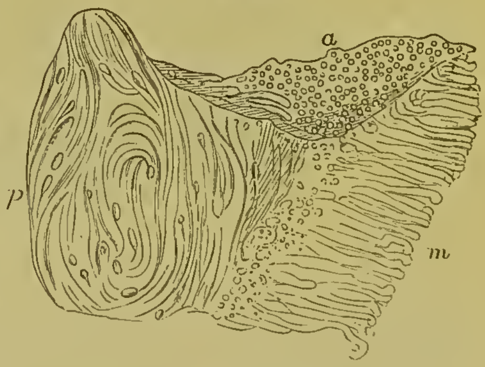
Fig. 32.



Tubular Gland of the Uterus. (Coste.)

In the unimpregnated uterus, in an inter-menstrual period, the tubular glands are not very easily seen; but if their sections are treated with acetic acid or concentrated tartaric acid, and viewed by transmitted light, they can generally be made out. They terminate quite abruptly at the inner margin of the muscular coat, the point of junction being very distinctly indicated by the muscular fibres running at right angles with the tubes. The glands were supposed by Sharpey to penetrate the muscular tissue, but this view is now generally regarded as an erroneous one. Their abrupt termination is well shown by a reference to Fig. 33. In the same preparation, which was taken from the uterus of a young girl who had committed suicide in the inter-menstrual period, is also shown the general direction of the fibres composing the proper tissue of the uterus, *p*, as compared with the course of the tubules from the free surface of the mucous membrane at *m*. At *a* the tubes are cut across, and shown obliquely in section, and the course of the blood-vessels which accompany them is also indicated between *m* and the adjacent part of the muscular tissue.

Fig. 33.



Relation of Tubular Glands to Muscular Tissue of Uterus. (Coste.)

Fig. 34, also taken from Coste's beautiful plates, shows a detached portion of the mucous membrane in the same case. Little funnel-shaped depressions are shown at *a*, into which the orifices of the tubes open.

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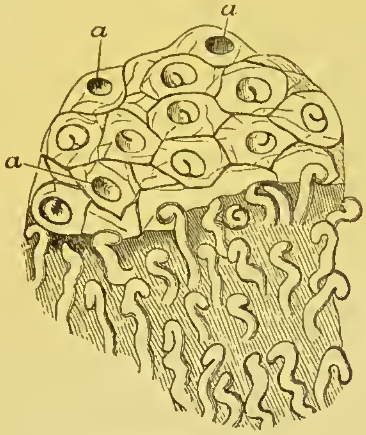
[1] De la Muqueuse Utérine. Paris, 1861.

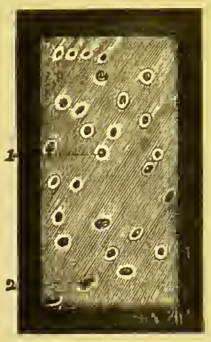
The actual glandular orifices are distinctly shown elsewhere on the surface of the membrane. From one portion, the epithelium has been stripped off, so as to show the termination of the tubes free and floating. But what is most distinctly demonstrated here, is the perfect net-work of vessels which surrounds the orifices, and which is always to be observed most distinctly at those seasons when the functional activity of the uterus is excited.

Fig. 34.



Termination of Tubular Glands on Mucous Surface of Uterus.

Fig. 35.



Tubular Orifices of Uterus. (Sharpey.)

Fig. 35 is a small portion of the mucous membrane as observed after recent impregnation. This specimen is represented as viewed upon a dark ground, and also shows the orifices of the uterine glands, in most of which, as at 1, the epithelium remains, whilst in some, as at 2, it has been lost.

The mucous membrane is smooth on its surface, which is composed of columnar and ciliated epithelium. Cruveilhier describes it, however, as presenting indistinct papillæ, while some earlier physiologists insist that it is studded with free villi; errors which have probably had their origin, as M. Robin assumes, in the extremities of the glandular follicles becoming liberated from their epithelial attachment by *post-mortem* change, and which find in analogy an apparent corroboration in the condition of the membrane as observed in the uterine cornua of some mammalia. During pregnancy, and also during menstruation, the epithelium becomes transformed, and loses all trace of the vibratile cilia.

Berres[1] was the author of the erroneous hypothesis that the villi of the placenta plunged into the tubular glands, to be there bathed in materials destined for the fœtal blood, a view which was afterwards supported by

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[1] Medicinische Jahrbücher des K. K. Œsterreich. Staates. Wien, 1837.

Bischoff,[1] but which now receives little if any support. M. Coste[2] was undoubtedly the first who gave a complete description of the mucous membrane during menstruation and the various stages of pregnancy. To him the merit is also due of having demonstrated, what is now universally admitted, that the maternal covering of the ovum (*decidua*), of which we shall have more to say, is not a new formation, as Hunter taught, but is the mucous membrane itself, altered and modified to suit the circumstances of the case. The views of Coste have received the most remarkable confirmation by the subsequent observations of Richard, and by the still more recent researches of Robin.

The mucous membrane of the uterine cavity is continuous at the angles with that which lines the Fallopian tubes. At the internal os, it becomes much thinner, with fewer glands, and loses many of its special characteristics as it passes into the cavity of the cervix. The presence of the folds, which give to it in this situation an arborescent appearance, has already been noticed. The extent of the inner surface of the cervix is thus greatly increased, an arrangement which not only admits of free dilatation of the parts, but also furnishes a greatly increased secretory surface. It has been computed by Dr. Tyler Smith that, in a well-developed virgin uterus, the follicles of the cervix (*glandulæ Nabothi*) are not less in number than ten thousand. These glands secrete a clear tenacious fluid, which is alkaline in reaction, and which is often seen on vaginal examination to occupy the os externum. They are liable during pregnancy to a very remarkable hypertrophy. The mucus which lubricates the parts during delivery is partly derived from this source, and in certain morbid conditions it is greatly increased in quantity, when it is either secreted of an acid reaction, or loses its alkalinity, and also its transparency, by contact with the acid mucus of the vagina. The cavity of the cervix is lined with an epithelium which in its lower half is squamous like that of the vagina. About midway between the outer and inner os, it assumes the characteristics of the ciliated and columnar epithelium of the cavity.

Blood Vessels of Uterus.—The uterus is supplied with blood from two sources. The *ovarian* arteries have their origin, like the spermatic in the male, from the aorta, at a point a little below the renal arteries. Passing over the psoas muscles, and occupying a fold in the peritoneum, which is indicated in Fig. 27, they pass between the layers of the broad ligaments—forming what have been described as the ovario-pelvic ligaments. They follow, in their passage towards the ovary, an extremely tortuous course, which admits of free extension during pregnancy without any risk of diminution of their caliber. Giving off branches to the ovary and round ligament, they now pass inwards to join the *uterine* arteries on each side. These latter spring from the anterior division of the internal iliac, pass between the layers of the broad ligaments downwards towards the neck of the uterus, then upwards, pursuing, like the others, a tortuous course and, after giving off numerous branches to the uterus, effect a union with the ovarian arteries. Frequent anastomoses take place, and the branches may be seen to lie in little canals or channels on the surface of the womb, before they penetrate more deeply. The veins correspond to the arteries just named, and are of considerable size. They form plexuses, which communicate freely, and during pregnancy their caliber becomes enormously increased. Within the substance of the uterus, the ramifications of the arteries retain their spiral form, but become straighter as they approach the mucous membrane, where fine branches surround the tubular glands, and ultimately form, as has been shown (Fig. 34), a fine network on the free surface of the membrane. The veins which convey the returning current are, at their origin, of small size, but become much larger within the substance of the womb, attaining, during pregnancy, a size so considerable that they are designated the *uterine sinuses.* The cervix is less vascular than the body and fundus.

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[1] Traité du développement de l'homme, &c. Paris, 1845.

[2] Histoire du développement des Corps Organisés. Paris, 1847.

Numerous lymphatics, which are fully developed only during pregnancy, have been traced to the uterus. Some doubt still exists, however, as to the precise source of the nervous supply. All agree that the chief supply is from the sympathetic system,—the hypogastric, renal, and inferior aortic plexuses being all believed to contribute. The idea generally entertained is, that the sacral nerves send some filaments to the cervix, and to the cervix only. This has been denied by Dr. Snow Beck,[1] and it has even been asserted by M. Jobert that no nerves whatever are sent to the vaginal portion of the cervix, but a study of the nervous supply in the case of other hollow viscera would lead us to infer, by analogy, that the idea above expressed is correct.

Development of Uterus.—While, as a rule, in the Mammalia, the vagina is single, the contrary is the case as regards the womb. In the female human embryo, the uterus is formed by the median fusion of the lower parts of the ducts of Müller—which are the efferent tubes of the rudimentary generative apparatus. These meet together inferiorly, become gradually united from below upwards, and ultimately form a single cavity by the absorption of the partition between the two, so that there is a stage in development at which the human uterus is composed of two separate and distinct tubes. It follows, from the manner in which they become united, that there is a series of subsequent stages at which the partly developed organ may be termed *uterus bicollis*—when the necks are still separate; *bicorporeus*—when the union has reached the os internum; *bifundalis*—when the fundus alone is divided; and, finally, the *uterus simplex*—the highest or perfect human form. In the other Mammalia, the process is so far identical, but may be arrested at any stage to form the uterus natural to the group to which the individual belongs. In the Marsupials, not only are the two uteri separate, but also the vaginæ. In a large number of the Rodents, the vagina is single, and into its fundus two distinct uterine cavities open by separate apertures; while, in some, there is a partial division in the vagina for about a third of its length. The commencing union of the cervix is shown in some groups of the same order—as the Muridæ—where there is a very short common cavity. The confounding of the two uterine cavities may be traced in various progressive stages by an examination of the internal organs of certain of the Carnivora, the Ruminants, the Ungulata, the Edentata, and the Simiadæ; but even in women there still remains in the angles of the uterus a trace of the original bifurcation.

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[1] Philosophical Transactions, London, 1846. Part II., p. 219.

Uterine Malformations.—This reference to the development of the uterus, and, for the analogy, to its condition in the lower animals, will be found to throw light upon certain cases of malformation or peculiarity of structure in the human subject, which apparently consist, for the most part, of a simple arrest of development. Taking the particulars above noted as a basis of classification, we may adopt the division in regard to those abnormalities which Dr. A. Farre, in his Essay on the Uterus,[1] has selected as the best. Of this section of his admirable monograph, the following remarks are in great part an abstract.

Group 1. Complete absence of the uterus, both of the ducts of Müller being imperfect or undeveloped. In the cases of total absence of uterus which have been recorded, it seems certain that, in a very large proportion at least, something of a rudimentary organ existed in the fold of the peritoneum lying behind the bladder, and representing the broad ligament. These rudimentary structures usually occur under the form of two hollow rounded cords or bands of uterine tissue, extending upwards towards the ovaries. The vagina may be absent or rudimentary, as also the Fallopian tubes; but it is interesting to observe that the ovaries may be perfect in these cases—a fact easy of explanation, when we remember that the ovary is formed out of a portion of blastema distinct from that of the Wolffian bodies and duct of Müller.

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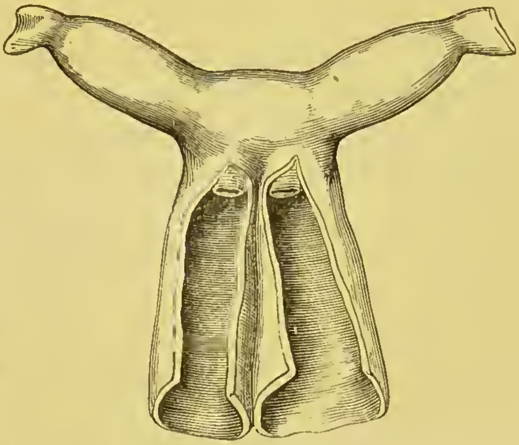
[1] "Cyclopædia of Anatomy and Physiology." London, 1859.

Group 2. One uterine cornu only may retain the imperfect condition last described, while the second develops, so that we now have what has been called the *uterus unicornis.* In this condition, which represents the type of the normal condition in birds, both ovaries may be found perfectly developed.

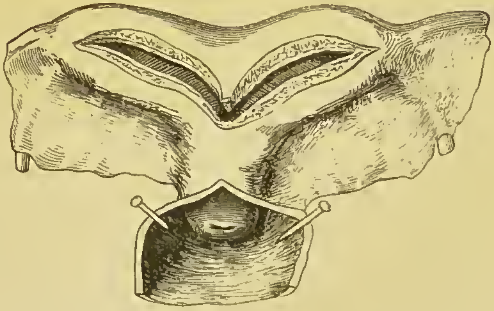
Group 3. When development progresses in both cornua, and these do not, as under ordinary circumstances, unite, various peculiarities result, which cause the uterus to assume, according to the degree of the malformation, a type which is lower or higher in the animal scale. "The marsupial type," says Owen, "is repeated in one of the rarer anomalies of the female organs in the human species." This, indeed, is an anomaly so rare and peculiar, that it has only been observed as co-existent with other malformations,—such as fissure of the abdominal and pelvic walls; but what is more frequently met with is the form shown in Fig. 36, where the two uterine halves meet, and are united by a commissure of true uterine tissue, which represents the fundus uteri. The higher this commissure reaches the more does the womb approach to the normal type. In the figure there are two vaginæ, two orifices, and two uterine cavities.

Fig. 36.



Double Vagina and Uterus. (After Busch.)

Fig. 37.



Bifid Uterus.

In the cases shown in Fig. 37, there is but one vagina. The os also is single, as is the cavity of the cervix, the bifurcation commencing about the os internum. The angle at which the cornua unite varies in different cases—which is accounted for, as is pointed out by Rokitansky, by the height at which the uniting commissure is situated.

Group 4. In this, the external form of the uterus differs but little from the normal character. The breadth of the organ is greater, especially at the fundus, where a depression in the middle line indicates the situation internally of a vertical septum, which more or less completely divides the uterine cavity into two halves, and constitutes the *uterus bilocularis.* The extent of this septum may vary from a mere ridge to a complete partition, which may even invade the vagina.

These several deviations from the normal form of the uterus will influence more or less the function of the organ. Menstruation may, it is true, in a large proportion of cases, be scarcely affected ; and this function will be normally discharged whenever the ovaries are perfect and an adequate channel exists. In those rarer cases, however, in which the uterus is rudimentary, there may be perfect ovaries, and atresia either of the cervix or of the vagina, with the result, if a uterine cavity exists, of an accumulation of the discharge, and attendant symptoms of considerable severity. If, on the contrary, there be no cavity, the menstrual molimen may then be relieved by the occurrence of vicarious discharges. As regards the influence exercised by such anomalies upon impregnation, much will depend upon the condition of the vagina, and also of the Fallopian tube, for if either of them are closed, impregnation is of course impossible. If, however, they are open, it is quite possible for impregnation to occur, even in a uterus unicornis.[1]

Great difficulty and danger may arise, in such cases, during the progress of gestation. In the case, for example, which is referred to in the foot-note, death took place from rupture of the sac in the third month, the termination being thus very much what one would expect in a case in which the development of the ovum goes on in the Fallopian tube, instead of in the cavity of the womb. In the cases of the uterus bicornis and bilocularis, either side of the uterus may become separately or alternately the seat of gestation, or twins may be simultaneously developed, one on each side. There is, indeed, no good anatomical ground for rejecting the doctrine of superfœtation as a possibility in such cases. When there is a double vagina, coition usually takes place by one canal, so that successive pregnancies may be looked for on the same side. The effects produced on the act of parturition by such anomalies as have been cited, have probably been exaggerated. Rokitansky has indeed shown that the axis of expulsion may, as in the one-horned variety, be so directed as to place the forces at an obvious disadvantage ; but it may be assumed that, if the anomaly has been of such a grade as to admit of complete intra-uterine development, there will probably be no impediment during delivery, which may not be surmounted by the application of ordinary principles.

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[1] See a remarkable case by Rokitansky, the preparation of which is in the Vienna Museum. (Pathological Anatomy—Syd. Soc., vol. ii., p. 277.)

Cases in which the arrest of development has taken place after birth, are to be placed in a special category. At the ordinary period of puberty, the signs which indicate sexual maturity do not appear, while the uterus is found still to present the characters peculiar to infancy or childhood. In these cases, which are almost certainly productive of sterile marriages, there is often an absence of the vaginal portion of the cervix; and the other infantine conditions of the womb may be exhibited in every particular, such as the exaggeration of the forward curve which, in a smaller degree, we have indicated as the normal adult condition, the persistence, within the cavity, of rugæ similar to those of the cervix, and the thinness of the parietes.

The Ovaries.—Projecting on either side from the posterior surface of the broad ligament, and invested with a special fold of its posterior layer, are the important organs within which is elaborated that which the woman contributes to the propagation of her species, analogous therefore in this, as in other respects, to the testicles of the male. They are connected (see Figs. 27, 28, and 29) with the uterus by a special ligament already described, and also, through the Fallopian tubes, to one of the fimbriæ of which they are permanently adherent. In shape, the ovary is a flattened oval. It varies greatly in size, according to age, and in different individuals of a similar age; but the mature organ may be set down as, on an average, about eighty grains in weight, and an inch and a half in extreme length. From the manner in which it is embraced by the peritoneum, it is free on two sides, and on the posterior border, and is attached to the broad ligament by a kind of mesentery along the anterior border only, where, between the layers, the vessels and nerves enter. The nature of the relation subsisting between the ovary and the peritoneum has of late been a subject of much interest to physiologists, and the observations of Waldeyer[1] certainly leave no room for doubt that anatomists were in error in describing the ovary as invested by the peritoneum in the same manner as the other viscera. The structure of the peritoneum proper ceases abruptly at a fold near the hilus, quite visible to the naked eye. This fold surrounds the ovary in such a way that the greater portion of its free surface consists not of the peritoneum, but of a special layer, continuous with the peritoneum, presenting, on microscopic examination, a prismatic epithelium instead of the laminated form which covers the serous membranes. This prismatic epithelium is intimately connected with the origin of the ova, and is, in consequence, sometimes called the *germinal epithelium.* The ovary attains its greatest size after puberty, and is, up to this period, smooth on the surface. During pregnancy, the position of the organ is completely changed; but in the unimpregnated condition it will be found lying deeply in the lateral posterior part of the pelvic cavity, covered by the small intestines, and to some extent by the Fallopian tube of the same side. Beneath the outer covering, a layer of the stroma, somewhat white in colour from a sparseness of blood-vessels, binds the proper structure of the organ together, giving support and protection to it, and to the important structures which it contains: this is the *tunica albuginea.* The bulk of the organ beneath this is composed of highly vascular tissue of a pinkish colour, which is called the *stroma* of the ovary. The stroma is composed of a dense fibro-nuclear tissue, through which blood-vessels ramify from the base of the ovary towards its surface.

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[1] Eierstock und Ei. Leipzig, 1870.

The Graafian Vesicles.—If a longitudinal section be made through a mature and healthy ovary, these vesicles are brought into view, imbedded in the stroma and varying considerably in size. In number and in situation, they differ greatly according to age. In infants and young children, the ovary is found to be composed, within the tunica albuginea, of two distinct portions,—one internal, corresponding to the stroma in the mature organ, and the other external, of considerable thickness and density. It is in the latter, or peripheral portion alone, that, at this time, the Graafian vesicles are to be found, in enormous numbers, but as yet of small size and in a rudimentary condition. Each is, as a rule, occupied by one young ovum, and it has been computed by Foulis[1] that at birth the human ovary contains not less than 35,000 ova. As puberty approaches, the distinction between the peripheral and central portion of the stroma becomes gradually less marked. Some of the vesicles enlarge, and, according to Schrön, retreat in the first instance towards the centre of the ovary. When puberty is attained, a certain number of them enlarge still further, and those which have attained the greatest size approach the surface. A few of them are from $\frac{1}{20}$th to $\frac{1}{6}$th of an inch in diameter, or even more; but the great majority remain much smaller. Their number is also greatly diminished as compared with those existing in the ovaries of children, so that we may assume that a large proportion are absorbed. The ova, which are contained within these Graafian vesicles, occupy in the case of the more developed vesicles a small space only, the rest of the vesicle being filled with fluid. Before puberty, the ovaries are smooth on the surface, but they subsequently become scarred, wrinkled, and furrowed, in consequence of the share which they take—as we shall see immediately—in the phenomena of ovulation.

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[1] Transactions of the Royal Society of Edinburgh, 1875.

The Graafian vesicle consists of two coats and a granular lining membrane, three special coverings in all, the outer being called by Waldeyer and others the *tunica fibrosa*, and the inner (which is lined by the *membrana granulosa*), the *tunica propria*. The outermost was at one time described as the *vascular layer*, but this is manifestly inappropriate, as it conveys the idea that the subjacent layer is comparatively free from vessels, which is not the case.

Fig. 38.

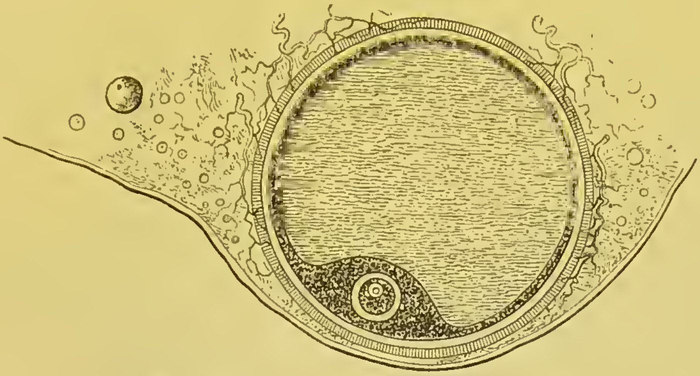
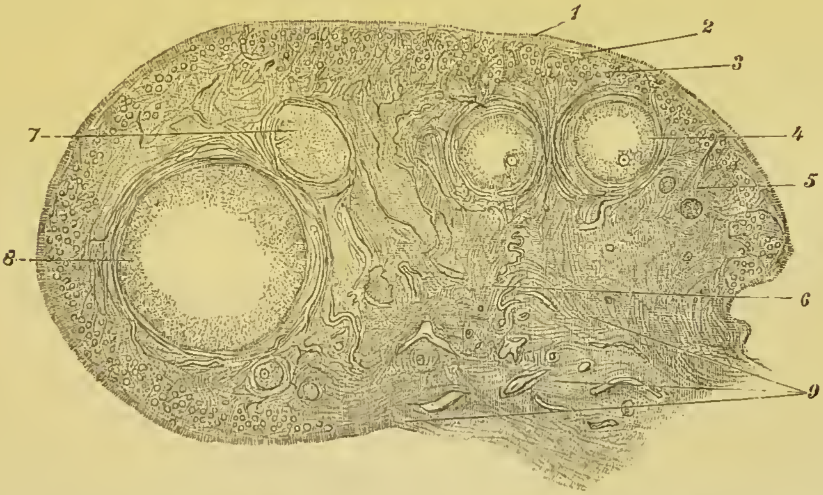


Diagram showing the Layers of the Graafian Vesicle and the contained Ovum.

Fig. 39.

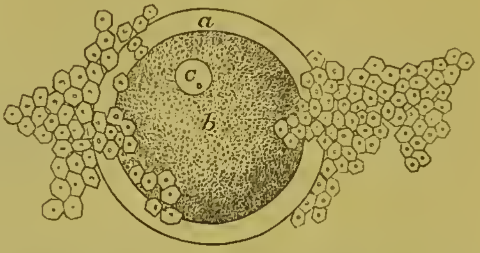


Transverse Section of the Ovary of a girl 8 years of age, 10 times magnified. 1 Germinal Epithelium ; 2 Tunica Albuginea, still feebly developed ; 3 Outermost Zone of the Cortical Substance, containing numerous Small Follicles ; 4 Larger Follicle ; 5 Inner Zone of Cortical Substance ; 6 Matrix of Ovary, containing numerous coiled arteries ; 7 Follicle opened ; 8 Large Follicle, whose *discus proligerus* has not been disclosed in the Section ; 9 Hilus of the Ovary, containing large veins. (Stöhr.)

The Ovum, in the mature condition of the Graafian vesicle, lies near its surface, and is embedded in the *membrana granulosa ;* a layer of peculiar nucleated and granular cells, which surrounds the whole of the interior of the vesicle, and is thickened at that part where the ovum is embedded in it (*proligerous disc* of V. Baer). All the earlier writers on the subject represent this disc as occupying the side of the vesicle contiguous to the surface of the ovary, as here shown (Fig. 38); but more modern research would seem to indicate that it is usually to be found on the opposite side. (See Fig. 39.)

If the surface of the ovary be punctured, where a mature Graafian vesicle is projecting, and the contents of the latter pressed out, the ovum, in the form of a small spherical body, may be observed covered with granular matter in greater or less quantity. It is more opaque than the medium in which it is suspended, and is composed of the following parts:—

Fig. 40.



Diagrammatic representation of the Ovum, as it escapes from the Graafian Vesicle.

a. A thick transparent envelope, which was called by V. Baer, the distinguished discoverer of the ovum in the Mammalia, the *Zona pellucida.* This is identical with the *vitelline membrane*, or *membrane of the yolk* in birds. It completely surrounds the ovum, and is to all appearance impervious. It presents at least no distinct aperture or micropyle, such as is observed in some animals and was at one time supposed to exist in the human ovum.

b. The *Yolk.*—The cavity enclosed by the zona pellucida is filled with a semifluid protoplasmic mass, which is viscid and faintly granular and which readily escapes when the sac is ruptured. It can scarcely be described as a fluid, as it retains its spherical form after rupture of the sac, and may, according to Bischoff, be broken into segments. It has no investing membrane other than the zona pellucida.

c. The *Germinal Vesicle.*—Imbedded in the substance of the yolk when fully developed, and in contact frequently with some part of the periphery of the investing membrane, a little vesicle is found, apparently quite transparent and colourless, when seen in the more opaque medium in which it is suspended. This is the germinal vesicle—first described in the ova of birds by Purkinje, and discovered in the Mammalian ovum by Coste and by Wharton Jones. It is slightly oval, and surrounded by a very thin membrane. A more careful examination of it, when removed from the yolk, shows that it is not absolutely transparent, but contains a few scattered granules, and, in addition :—

d. The *Germinal Spot* of Wagner, which may be seen close to some point or other of the inner surface of the wall of the germinal vesicle. It is probably formed by the aggregation of cells and granules which give to it a greater opacity than characterizes the contents of the vesicle.

Development of Ova.—The ova begin to be formed at a very early period, and are already to be found in great numbers in the superficial layer of the rudimentary stroma of the human ovary, as early as the fourth month of intra-uterine life. But their first origin is even earlier, whilst their formation is believed to continue for some time after birth. But, as the development of the tunica albuginea cuts off the germinal epithelium from the deeper parts of the ovary, we may infer that the appearance of new ova ceases with the second year. The germinal vesicle is the part of the ovum first observed, and it appears to be formed by involution from the superficial layer of germinal cells. One or more of these cells, becoming larger than the rest, sink into the stroma and soon become surrounded by a single layer of nucleated cells. This constitutes the commencement of the membrana granulosa, and represents therefore the Graafian vesicle. As development proceeds, a small quantity of protoplasmic yolk surrounds the germinal vesicle, and the cells of the membrana granulosa increase in number and assume more of the appearance of a cellular lining. At this stage, the ovum occupies the entire cavity of the rudimentary Graafian vesicle, and when the zona pellucida has been formed it may be seen as shown in Fig. 41. In Fig. 42, where it is

Fig. 41.

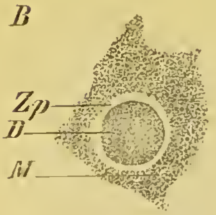
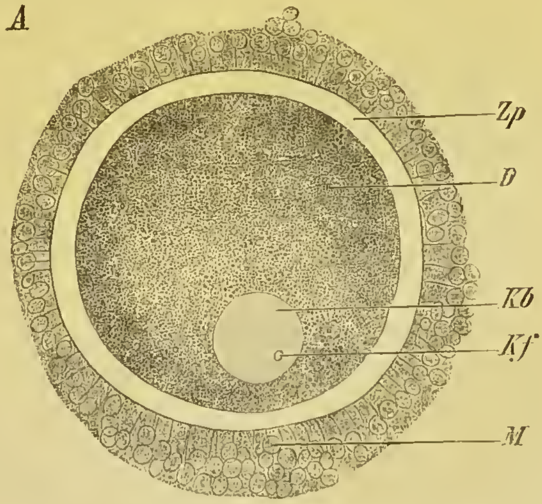


Fig. 42.

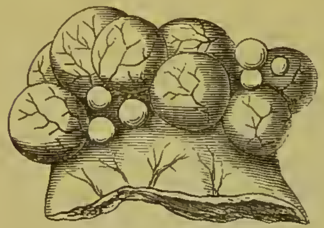


Ovum from the Graafian follicle of a cow. A 50 times: B 240 times magnified. (Stöhr.)

more highly magnified, its various parts can be clearly recognised, *Zp* being the zona pellucida, *D* the yolk, *Kb* the germinal vesicle, and *Kf* the germinal spot. The cells at *M* and elsewhere in the whole circumference of the membrana granulosa are undergoing rapid proliferation. Histologists do not seem to be entirely agreed as to how the cavity of the Graafian vesicle is originally developed, but it would seem that it is first observed at some little distance from the ovum. While the latter increases in size, the vesicle grows much more rapidly, from an increment in the amount of the *liquor folliculi* contained within its cavity, and the ova themselves are now found to be imbedded in a nipple-shaped projection of the granular membrane, within which it remains until, on the complete maturity of the vesicle, the parts are broken up and the ovum discharged. The ovum grows by the increase of the yolk round the germinal vesicle, the protoplasm becoming granular, while the zona pellucida becomes more distinct and firmer in texture.

These, then, are the parts of which the mature ovum, prior to impregnation, consists. At the period of puberty, as has been seen, several Graafian vesicles, each containing an ovum, approach the surface of the ovary. As they increase in size, they form little projections beneath the investing membrane. In those animals in whom several ova are simultaneously fecundated—as in the sow (Fig. 43)—there may be observed on the surface of the ovary a number of little cystic growths; but, in the human species, where the fecundation of more than one ovum at a time is exceptional, the Graafian vesicles, as a rule, come to maturity one by one.

Fig. 43.



Development of Graafian Vesicles in the Sow.

Ovulation.—The changes which take place during the maturation and discharge of the ova, and which are associated with the "rut" in many of the lower Mammalia, and with menstruation in women, constitute the phenomena of Ovulation. These changes are manifested, not only in the Graafian vesicle, but also in all the component parts of the internal generative system.

It has already been observed that the development of the Graafian vesicle is due, in great measure, to the increase in its fluid contents. While ovulation is taking place, the vascularity is notably increased, not only in the vesicle itself, but in the contiguous portion of the ovary, and, in some degree, throughout the whole of the organ. The walls of the vesicle become thickened, except at the part where rupture is about to take place, and a certain amount of blood is said to be effused into the cavity. This has frequently been observed in the sac of ruptured follicles; but the researches of Pouchet—whose views are confirmed by Farre—seem to show that an actual sanguineous discharge takes place into the Graafian vesicle at a period prior to its rupture.

An increased vascularity is now observed externally, over the salient portion of the vesicle, and the tissues become, about the centre of the projection, more and more thinned, until, at last, they yield—the ovum then escaping by a process analogous to dehiscence. The rupture takes place in a small spot, where the blood-vessels previously are wanting, similar to the larger band of non-vascular tissue which exists in the ovicapsules of birds. Towards this non-vascular spot the neighbouring vessels converge in considerable numbers, causing the appearance we have just referred to. Assuming the theories above mentioned to be correct, the bursting of the vesicle is due, not merely to an augmentation of its fluid contents, but to a thickening of its internal layer, which becomes at the same time irregular in outline and yellowish in colour; and also to an effusion of blood, which has been termed the menstruation of the vesicle.

This evolution of the ovum is accompanied by important changes in various parts besides the ovary. In so far as the uterus is concerned, these changes will come to be considered under Menstruation. At present, it need only be observed that the whole of the internal genital organs become engorged. The Fallopian tube loses its pale colour internally, and often becomes of a violet hue from extreme congestion, especially towards the fimbriated extremity. On the occurrence of rupture, the ovum is supposed to move towards the gaping orifice of the Fallopian tube, impelled, in all probability, by the action of the cilia which are situated on the inner surface of the fimbria which is in permanent connection with the ovary. The rupture, however, which admits of the dehiscence, does not terminate the series of changes of which the ovary is the seat.

Before attempting a description of these changes, we must consider for a moment the conditions under which rupture of the Graafian vesicle occurs, and the laws which determine this rupture.

The celebrated experiments of Bischoff, as detailed in his well-known work,[1] have supplied most of the facts upon which, even at the present day, the conclusions of physiologists on this subject are based. From those, and from the corroborative results obtained by subsequent observers, it is clear that ova may, in the Mammalia, as in animals lower in the scale, be discharged from the ovary independently of sexual intercourse, or of any kind of influence from the male.[1] In other words, sexual contact or excitement is not, as the earlier observers, down to Barry, believed, the one essential determining cause of the discharge of ova. From experiments on rabbits, which were conducted by Coste, it seems, however, more than probable that sexual congress may precipitate a rupture which, but for the excitement, would have been delayed. The immediate cause which leads to a rupture is thus somewhat obscure, but we recognise the fact that the occurrence is intimately associated with the maturation of the ovum, of which, in women, the periodic menstrual flow is probably the external manifestation.

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[1] Beweis der von der Begattung unabhängigen periodischen Reifung und Loslösung der Eier, &c. 1844.

Corpus Luteum.—We have already seen that the internal layer of the Graafian vesicle presents a yellow colour previous to its rupture, becomes wavy in outline, and is very considerably thicker. This change of colour was said by Farre to be due to the presence of very minute oil granules, which give to the structure a yellow hue,—hence the name given to the vesicle during the period of decline—the Corpus Luteum. After rupture, a laceration, fissure, or scar, marks, on the surface of the ovary, the spot whence the ovum escaped, and a longitudinal section, made through the ovary in this situation, will generally bring the yellow body into view. At first, its distinguishing characteristics are but faintly shown; and it is this fact which caused Raciborski to assert that the corpus luteum was not found before rupture. Undoubtedly, however, the first stage of its formation is while the ovum is still within the vesicle; but it is only after rupture that the change in colour becomes quite distinct,—a change which Raciborski supposed to be due to an absorption of colouring matter from the blood-clot which fills the cavity. Whether it is due in part to this, or wholly to a further development of oil granules in the internal layer, as Coste supposed, the result is the yellow tint, which may be recognised from without, or, more distinctly, on section. If the laceration has produced an opening of sufficient size, the clot which occupies the cavity may escape along with the ovum; but, if not, it is retained and absorbed. The folding of the internal layer now becomes much more distinct, so that the inner surface of the vesicle resembles cerebral convolutions on a minute scale. According to Coste, this plication is due in great measure to contraction of the external coat, but this does not seem by any means clear, seeing that the convolutions become quite as distinct in those cases where the diameter of the whole vesicle is not diminished. It is much more likely that the plication is mainly due to the rapid increase in the cells of the tunica propria, which, being confined within a limited space, is thus necessarily thrown into folds. In every case, the cavity of the vesicle becomes rapidly encroached upon, the furrows between the convolutions become deeper, and the result is that the follicle now presents, in a section, a stellated appearance, which is more or less marked according to the stage at which the corpus luteum has arrived. The various changes above alluded to are shown in Fig. 44, taken from Coste's Atlas, which represents an actual dissection, made at the Morgue, of the ovary of a young woman who had committed suicide towards the end of a menstrual period. It must here be noted, however, that the most recent observations have failed to demonstrate with equal clearness the layers of the

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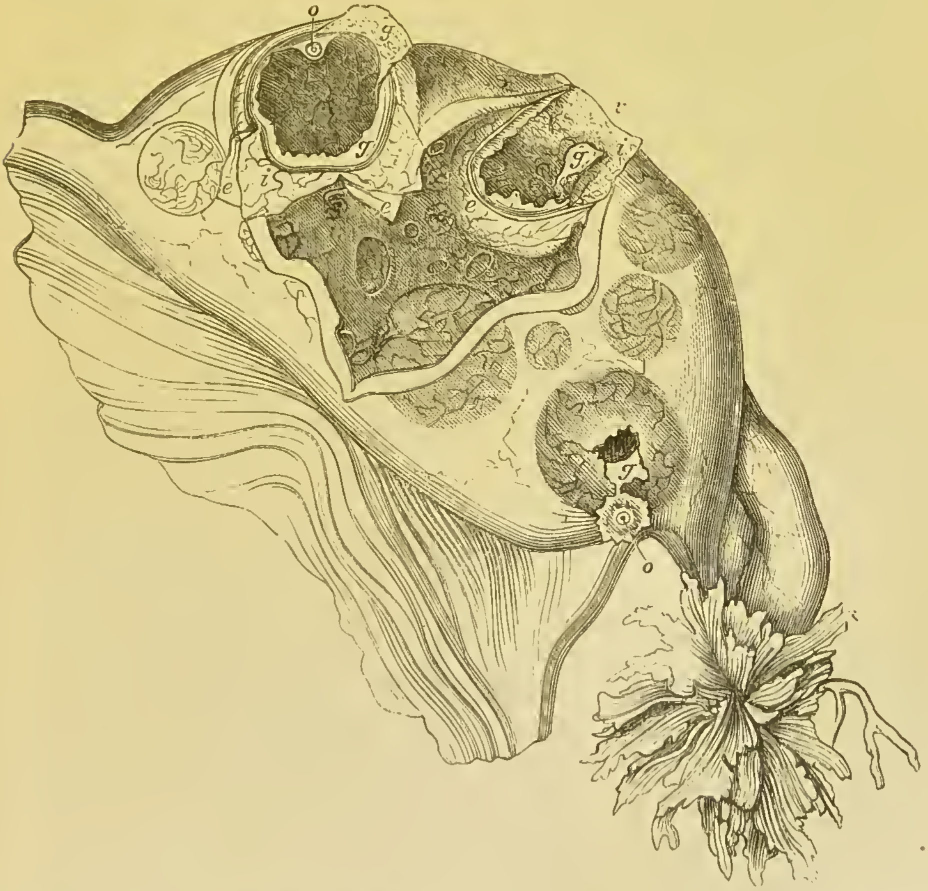
[1] See Raciborski "De la ponte périodique chez la Femme et les Mammifères." 1844.

Fig. 44.



Ovary Dissected, to show the structure of the Graafian Vesicle at various stages. (Coste.)

Graafian vesicle which Coste has so distinctly indicated, while the position of the ova and various other features seem to suggest that Coste's illustrations are diagrammatic, and founded upon previous impressions, rather than (as he would seem to indicate) exact representations of observed facts.

The ovary is partly dissected, to show the situation of the ova, and also the structure of the Graafian vesicles, with the changes which these undergo after rupture. Most of the vesicles are turgid, tending to protrude, and indicated by the network of vessels on their walls. Three of them are open.

"1. The vesicle to the left in the figure is intended to demonstrate the following peculiarities:—

g g. The granular membrane, which covers the whole internal surface of the Graafian vesicle.

A thickened portion of this (granular disc) shows:—

o. The Ovum surrounded by the cells of the disc, and situated on the side next the peritoneum.

i i. Internal layer of the Graafian vesicle, showing a rich vascular network, not only on the flaps which are turned back, but also in the interior of the vesicle, through the granular membrane.

e e. External layer, vascular like the former.

2. The open Graafian vesicle in the centre of the figure has broken spontaneously at the point *v*, and has allowed its ovum to escape. The nipple-shaped part of the granular membrane, in which the ovum was imbedded, has escaped along with it.

g. Layer of granular membrane, which has not been dragged out with the ovum.

i. Internal layer of the Graafian vesicle, forming numerous folds, which are the earliest of the modifications through which this layer passes in the formation of the Corpus Luteum.

e. External layer of the Graafian vesicle, retracted (*sic* Coste) on the former.

3. The third Graafian vesicle, to the right, has been artificially pierced to show how the ovum, while escaping, drags with it that portion of the granular membrane in which it is lodged.

g. Portion of the granular membrane, escaping by the opening made in the Graafian vesicle.

o. Ovum lodged in the thickened nipple-like projection of this membrane."

Coste denies the presence, as a rule, of a blood-clot within the Graafian vesicle. He asserts that the vesicle, after rupture, becomes filled with a gelatinous matter, which is slightly tinged with the colouring matter of the blood. This he shows in Fig. 45, where the ovary is divided in its whole length to exhibit the organization of the corpus luteum. The preparation was taken from a woman, the mother of several children, who died from poison a few days after menstruation. The body was exhumed and examined a week after death. No ovum was found in the uterus, nor in the Fallopian tube. An open corpus luteum, of considerable size, is here shown.

The description given, up to this point, applies to all corpora lutea, whether associated with pregnancy or not. It is therefore scarcely necessary to add that Haller was in error when he stated that "the corpus luteum is the effect of pregnancy alone." The demonstration of this error caused many hastily to assume that the corpus luteum was under no circumstances a sign of pregnancy, and was, in consequence, of no medico-legal value,—an unfortunate mistake, which has been productive of much confusion, as there certainly are points of difference which enable us, in most cases, although not in all, to distinguish between the two varieties.

MARY'S HOSPITA
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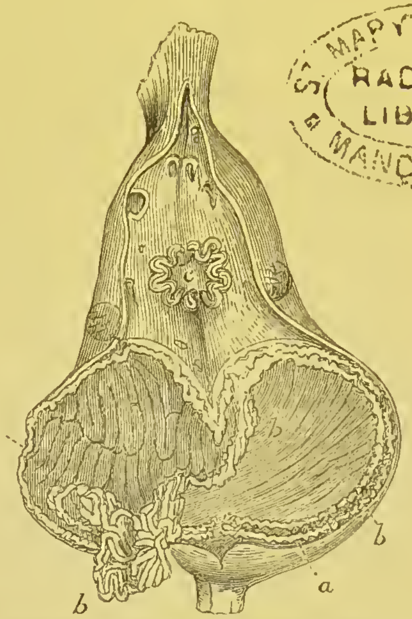
Fig. 45.



Structure of the Corpus Luteum. (Coste.)

"*a.* Internal layer of the Graafian vesicle, plicated and having commenced that hypertrophy which converts it into a corpus luteum.

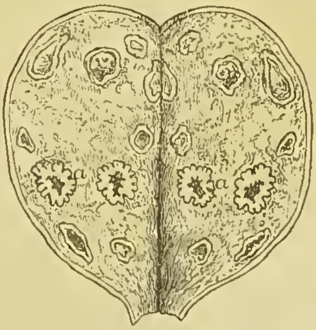
b. Plastic semi-transparent matter, which occupies the centre of the corpus luteum, adheres intimately to the internal surface of the convolutions, and moulds itself upon them. To the right, this matter is left in its place; on the left it has been detached, to show the subjacent convolutions and the impression which they leave upon it.

c. An old corpus luteum, from a preceding menstruation,—probably the one before last.

Graafian vesicles,—some intact, others open, and in various stages of development, are seen in other parts of the ovary."

Corpus Luteum of Ovulation.—The corpus luteum which is found when there has been no impregnation, or, in other words, after simple ovulation, runs something like the following course from the point at which we left it. It shrinks rapidly, and the contiguous surfaces of the convolutions become pressed together, while their free surfaces gradually approach across the cavity, so as rapidly to cause its obliteration. The vascularity of the vesicle, and of the stroma of the ovary, becomes notably diminished; the tunica propria loses its yellow colour, and becomes white,—all these changes, occurring in about twenty-five or thirty days, so that, on the approach

Fig. 46.



The Corpus Luteum of simple Ovulation.

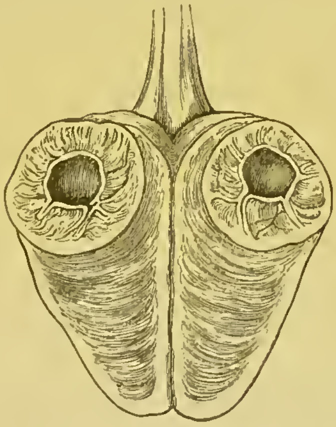
of another menstrual period, the cavity is reduced to a very small size. At this stage, its appearance, as represented in Fig. 46, *a*, is very characteristic, the rays which proceed outwards from the central cavity showing the point of contact of the convolutions. Several other vesicles are shown, of the ordinary size before enlargement. From this stage, the stellate remains of the vesicles gradually diminish in size, and retreat towards the centre of the stroma, to give place to others, until at last they are obliterated. Sometimes, they soften so rapidly, that they are completely re-absorbed before the folds of the internal layer have actually come in contact or contracted adhesions.

Corpus Luteum of Pregnancy.—Widely different is the state of matters where the ovum has been impregnated. In this case, the functional activity of the uterus is, in a measure, shared by the ovaries, and manifests itself in an increased vascularity, which, instead of disappearing, as at the end of a menstrual period, is maintained, more or less, during the whole course of the pregnancy. It is probably in consequence of this that the corpus luteum of pregnancy goes through a series of transformations which are much more elaborate, and which extend over a much longer period. Taking the duration of the corpus luteum of ovulation as about two months to complete obliteration, that which accompanies pregnancy may be said to last usually for thirteen or fourteen months, while traces of it may be found at a still later period.

Such an history involves the idea of special structure and modified development, and this a study of the facts amply corroborates. When pregnancy succeeds or accompanies the phenomena of ovulation, the earlier changes are the same as those already described; but instead of softening and rapidly shrinking, as in the former case, the inner coat continues to develop in thickness, and deepens in colour. There does not seem, in the first instance at least, to be any contraction whatever of the tunica fibrosa. On the contrary, there is some reason to believe that, at this stage, it often yields, so as to admit of an increase in the entire diameter of the vesicle, and, indeed, if we admit Coste's description to be correct, when he describes the corpus luteum of pregnancy as being occasionally "as large as the ovary itself," this can only be accounted for in the manner described. The size of the ruptured vesicle varies considerably, but it sometimes occupies, during the first four months, a fourth, a third, or even a half of the entire ovary. During the period immediately succeeding impregnation, rapid hypertrophy of the inner coat goes on, and it becomes folded together into convolutions as before. The material being abundantly supplied, while the development still continues, causes the convolutions to be firmly pressed together, while their free surface encroaches upon the cavity. At the end of two months, the condensation of this hypertrophied tissue will be found to have imparted to the corpus luteum a considerable amount of solidity, which is quite obvious when it is pressed by the finger. Blood-vessels run through it, from the circumference towards the centre, marking, probably, the situation of the original folds. These latter are no longer distinct, and are so compressed laterally that the layer has now the appearance of a very thick yellow coat, surrounding the diminished cavity, which is up to this time, according to Montgomery, usually circular in form, as shown in Fig. 47.

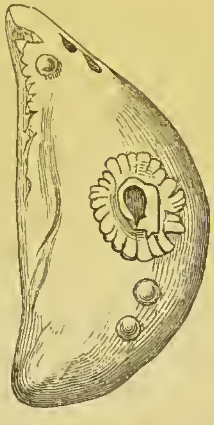
The blood-clot which originally occupied the cavity, or, if we choose to adopt the view of Coste, the tinged lymph which is effused after rupture, undergoes certain metamorphoses, which ultimately result in the formation of a milk-white coat which lines the cavity, taking the place, as it were, of the original granular membrane. This membrane, which is also shown in Fig. 47, is fibrous in structure, and extremely tough. Occasionally, the cavity is obliterated at the fourth month, but generally it will still be found perfectly distinct, although much reduced in size, up to the sixth month of pregnancy (Fig. 48). The walls continue gradually to approach nearer to each other, the white lining membrane becomes thinner and arranged in folds, which, radiating outwards, are seen to intermingle with the yellow colour of the ovisac. The outer boundary of the vesicle now becomes irregular in outline, and complete obliteration of the cavity ensues, a white stellated cicatrix in the midst of the yellow mass marking where its walls came into contact. This is shown in Fig.

Fig. 47.



Corpus Luteum in the Third Month of Pregnancy. (Montgomery.)

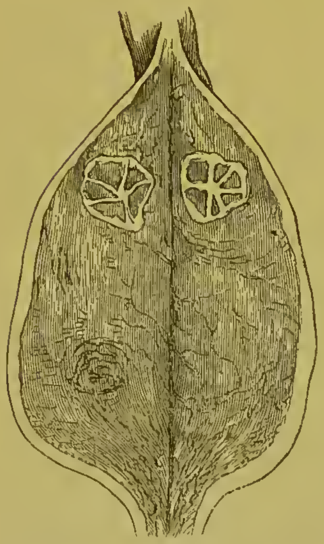
Fig. 48.



Corpus Luteum at the Sixth Month of Pregnancy. (Montgomery.)

49, the original drawing of which was taken by Montgomery from a woman who had died of inflammation of the uterus two days after mature delivery. Up to this time, and often for some weeks afterwards, numerous vessels radiate through the corpus luteum, as may be proved by injection. This vascularity, however, now becomes markedly diminished, whilst, at the same time, the characteristic yellow colour becomes fainter in hue. It is often not till four or five months have elapsed that all trace of the corpus luteum has disappeared, a trace of the tough white membrane being then, it may be, still indicated by a very faint star-like scar in the stroma of the ovary.

Fig. 49.



Corpus Luteum at the Period of Delivery.

As the facts above set forth are of some medico-legal, as well as obstetric importance, they may be briefly summarized as follows:

What is called the Corpus Luteum is due to a deposit of colouring matter in, and hypertrophy of, the internal layer or membrana propria of the Graafian vesicle.

The formation of a corpus luteum always succeeds the rupture of a Graafian vesicle.

Up to a certain point the changes in the Graafian vesicle are uniform, and have no relation to pregnancy. The corpus luteum of pregnancy may, however, be distinguished in its subsequent course, by its higher development and longer duration, its hardness, its vascularity, and, at a later stage, by the formation of the white lining membrane, and large central stellate cicatrix.

The presence in the ovary of a corpus luteum is no evidence of pregnancy, unless the characteristics last indicated are distinct and unequivocal. Many, indeed, doubt whether we are in any case justified in forming an opinion as to pregnancy on this evidence alone.

With reference to the above conclusions, it may be remarked that much confusion has arisen from the employment loosely of the terms "true" and "false," as applied to the corpus luteum, in so far as they are assumed to imply a distinction, which proves or disproves the occurrence of pregnancy. "There is as little reason," says Farre, with justifiable emphasis, "for the use of the last term as there would be for denominating a child a false man. . . . These terms actually represent the same body, only in different stages of growth or decay." The only condition, indeed, which could with propriety be designated a "false corpus luteum" is some morbid growth such as is represented in the upper part of Fig. 46.

During the whole of the child-bearing period of a woman's life, the ripening and dehiscence of the Graafian vesicles are of periodic occurrence. In those animals in which plural births are the rule, several vesicles ripen and discharge their contents at, or near, the same time: but in man this is exceptional, and we thus find that one vesicle only, as a rule, ripens at a time, bursts, discharges its contents, and rapidly shrinks as it retires towards the centre of the ovary; to give place, in a normal condition of the parts, to a constant succession of vesicles, which, one by one, run a similar course after discharging their ova. There is every reason to believe, further, that during pregnancy and suckling, the functions of the ovary are temporarily arrested, in so far as the development of new Graafian vesicles is concerned,—the whole generative force being, as it were, turned into other channels.

The numerous lacerations which, in consequence of repeated ruptures, take place on the surface of the ovary, leave, in the process of healing, corresponding cicatrices. On this account the smoothness of surface is soon lost, and it becomes more and more fissured and wrinkled, until, towards the end of the child-bearing epoch in a woman's life, the ovary is so irregular on the surface, as to warrant the comparison which Raciborski has instituted between it and the kernel of a peach. After this, the organ becomes atrophied, and, like the uterus and other parts, is restored, in some measure, to the form which it presented in early life.

CHAPTER V.

MENSTRUATION AND CONCEPTION.

The "Rut" of Mammalia: Analogy between this and Menstruation.—The first Menstrual Period: statistics of Duration of a "Period."—Quantity of the discharge.—Menstruation a hæmorrhage.—Source of the Menses: various theories regarding it.—Pouchet's Theory examined; Menstrual Decidua.—Views of Kölliker, Coste, &c.—Duration of Childbearing Epoch.—Cause of Menstruation.—Conception.—Composition of the Semen.—Spermatozoa and their development.—The function of the Germinal Vesicle.—How does the Semen reach the Ovum?

The Rut of Mammalia.—There is, in the animal kingdom generally, a certain periodicity in the phenomena which attend the maturation of the Ovum. In the Mammalia, there always is a period of excitement, in which the whole generative apparatus more or less participates, succeeded by a period of rest, of longer or shorter duration, according to the group or species, during which the organs involved are in a state of complete or comparative quiescence. The first marks the period at which the ovum is ready for impregnation; during the latter, sexual congress, is, as a rule, ineffectual. This term of excitement, which is accompanied by general and local symptoms to be noticed presently, is called, in mammals lower in the scale than man, the *rut* or *œstrus*.

There is not the slightest doubt that, in those animals, the escape of the ova from the ovary, and their passage down the Fallopian tube, are facts which coincide with the œstrus. The female then manifests an instinctive desire for copulation, and is generally said to be at this time "in season" or "in heat." The pudendum is congested and swollen, and the glands in this region pour out an abundant secretion, which, by its odour, attracts the male. This secretion, unless in those animals which come nearest to man in the scale, is very seldom even tinged with blood. In some cases, as was demonstrated by Bischoff in the case of the roe, the rut occurs only at intervals of a year, about the month of August. It is only at this period that the ovaries of the female contain ripe ova; and, what is of even higher physiological interest, the semen of the male is elaborated then and then only, so that impregnation is doubly impossible, except at a definite period, thus leading to the birth of the young at that time of the year when they may be most easily reared. But, in many animals, the maturation and dehiscence of the ova occur with much greater frequency, and it is probable that food, domestication, and careful tending, may modify the return of those periods.

Menstruation.—In women, during the period of ovulation, there are, as has already been shown, certain essential phenomena which are, so far, almost identical with what we observe in other mammalia. But there is here a special phenomenon superadded, which is in fact the external manifestation of what we know to be taking place internally. This consists in a discharge from the uterus of nearly pure blood, which lasts usually for several days. It is called the "catamenial" or "menstrual" discharge, as it occurs very constantly at intervals of a month; the occurrence being, in its course, usually designated as Menstruation.

A very warm discussion has been maintained for many years as to whether the "rut" and "menstruation" are to be held as analogous. Up to a certain point, the analogy is admitted by all; but it must be conceded that, between the two, distinctions and even contrasts are found, on careful examination, to arise, which seem to challenge the truth of the assertion which many have made, that the phenomena are physiologically identical. Without expressing any confident opinion as to this *quæstio vexata*, we may here mention the chief points, in addition to the sanguineous discharge, in which they differ. Impregnation takes place during the excitement of the rut, while as a general rule it occurs in women about a week after menstruation, during the period of rest. Again, there succeeds to the rut a period of sexual inappetence, when not only does the female refuse the male, but in some cases no semen is, as we have seen, secreted; in the human species there is, strictly speaking, no period of inappetence, not even excepting the period of the menstrual discharge, so that at any time impregnation *may* occur. Great as these differences undoubtedly are, and even if we admit that they destroy the identity of the acts, they are scarcely sufficient to warrant us in rejecting the analogy; for, although the subject is still obscure, a more accurate knowledge of the time occupied by the descent of the human ovum may show that the above points of contrast are more apparent than real.

Menstruation is familiarly termed by women the "courses," "monthly illness," or "period." It is not to be looked upon as an isolated act, but as one of the important series of phenomena which occur during ovulation; and as such it requires special and careful attention. Its first appearance is associated with the other signs of puberty. The approach of this is indicated by an alteration in the form of the pelvis, and a consequent change in figure and gait, by the growth of hair on the pubes, the rapid development of the mammæ, the greater projection of the nipple, and the deeper colour of the areola. These physical modifications are generally associated with very characteristic moral changes. A frank romping manner gives place to one more timid and gentle, and the loud voice and ringing laughter of childhood is replaced by subdued tones and bashful reserve. A Graafian vesicle now for the first time comes to maturity, and projects on the surface of the ovary, while the whole of the organs, including the uterus, become highly congested, and the menstrual flow probably begins, then or shortly afterwards.

Menstrual Molimen.—According to Boerhaave, the first menstruation is accompanied with a certain amount of fever, as the result of the excitement of the genital organs. The girl complains of lassitude, hypogastric fulness, lumbar and sacral pains, slight itching and tumefaction of the external genitals, and a painful swelling of the mammæ. Not unfrequently, hysteria, chorea, and other nervous disorders, manifest themselves,—generally in a mild form. After a few days, a mucous discharge, more or less abundant, is observed; this becomes tinged with blood, and after a time is found to be almost pure blood, to be again replaced by a tinted, and finally by a clear discharge, closely resembling that which at first showed itself. The previous symptoms disappear with the menses, which may have lasted a week, and she is restored to perfect health, but with an indescribable something in manner and appearance which marks the transition into womanhood. Such symptoms as are above detailed, on the authority of Boerhaave, as accompanying a first menstruation, are generally slight in degree, the discharge often appearing during sleep, or at any other time, without anything whatever of the nature of premonitory symptoms. Very often, for a period or two, some of the same symptoms are experienced, at intervals of a month, without any flow of blood. These may possibly indicate preliminary or abortive attempts on the part of nature,—the Graafian vesicles being, probably, as yet, not perfectly mature; but there is little reason to doubt, that the first maturation of a vesicle is, as a rule, coincident with the first menstrual discharge. Although some women menstruate without any marked disturbance of the system, it is rare to find a case in which some evidence of such disturbance cannot be discovered. An increase in vascular tension, excitement of the glandular system generally, especially of the mammæ, a feeling of feebleness and sometimes pain in the pelvic region, general *malaise* and hysterical developments are among the phenomena most frequently noticed. They are strictly physiological expressions, and are only to be looked upon as pathological when in excess, constituting along with many other manifestations what is called the menstrual molimen.

The initiation of this period of a woman's life is believed to be hastened by hot climates, by residence in towns and the habits which are there contracted, and by constitutional vigour; while cold temperatures, country residence, and a feeble and delicate temperament retard the act. In a certain number of cases, menstruation is postponed to a period of life much more advanced than usual. We read, for example, of a case in which a woman who had married at twenty-seven, menstruated for the first time two months after her eighth labour; and of another who had no discharge till after her second marriage, at the age of forty. Numerous cases of premature menstruation are also on record, where menstruation has actually appeared during infancy, and where the external appearances and sexual desires of maturity have been manifested at a very early age. Such cases are, of course, extremely rare; but of more frequent occurrence are those instances in which women become pregnant without ever having menstruated; while it is quite a common thing for a woman who is nursing to become pregnant again before the menses have returned, such facts indicating, as Cazeaux observes, that menstruation plays a secondary part in the phenomena of ovulation.

Period of First Menstruation.—Putting such exceptional cases aside, as irregular and abnormal, we at once recognise the fact that the time of a first menstruation varies greatly, according to climate, constitution, and the kind of life which is led. In so far as climate is concerned, the influence exercised by it, while quite marked, is by no means so considerable as was once believed, and may be represented by a period of three years at the furthest between the extremes, which we may suppose to exist in the Hindoo and the Esquimaux. At one time, ideas were entertained on this subject which more correct observation has shown to be absurd, and to no one are we more indebted than to Mr. Roberton, of Manchester, for clearing away the errors which were long promulgated on these points. The following Table, which shows the period of the first menstruation in 8,983 cases, is the result of a very careful analysis of the most reliable statistics which have been published in Europe on this subject.

Some idea is here given of the variation in the different countries of Europe, and we notice the very small proportion of cases in which menstruation first appears under ten or over twenty-two years. The period, as will be observed, varies very considerably, about the age of sixteen being the time at which it most frequently shows itself in this country. At any age, however, between twelve and twenty, the function may be established, without any peculiarity whatever in the attendant symptoms or deterioration of the general health; but, if beyond these limits, it may be looked upon as exceptional and irregular, although even then, as in the cases alluded to, the health may in no way suffer.

Once established, the menses should return with periodic regularity during the whole child-bearing epoch. The recurrence of the discharge is always attended with the local, and generally with the constitutional, symptoms above detailed. The latter are identical with those which accompany the first menstruation, only less in degree. The only circumstances which normally arrest this function of the uterus are pregnancy and lactation, during which the ovarian functions are in complete abeyance. If, under other circumstances, it should disappear

AGE.	ENGLAND.	FRANCE.	GERMANY.	NORWAY.	RUSSIA.	TOTAL.
	Roberton, Lee, Whitehead, and Murphy.	Brierre de Boismont, Raciborski, Bouchacourt.	Osiander.	Faye.	Lebrun.	
Under 10	14	16	...	...	...	30
10 to 11	64	41	...	...	...	105
11 — 12	103	138	...	..	...	241
12 — 13	278	209	3	4	...	494
13 — 14	595	258	8	4	...	865
14 — 15	1034	355	21	13	1	1424
15 — 16	1178	411	32	14	15	1650
16 — 17	1307	349	24	20	27	1727
17 — 18	714	287	11	13	35	1060
18 — 19	531	190	18	13	13	765
19 — 20	213	102	10	6	6	337
20 — 21	104	66	8	8	2	188
21 — 22	18	31	1	3	1	54
Over 22	17	23	1	2	...	43
Total,	6170	2476	137	100	100	8983

during the child-bearing epoch, it is regarded as an indication of some morbid condition, usually constitutional, which declares itself as a rule by the presence of other symptoms. It may last from one to eight days, four being perhaps about the average.

The catamenial period and interval together occupy a period of a month of four weeks, or twenty-eight days. This is the rhythm of the act in such a large proportion of cases, that we may set it down as the rule; but it is a rule to which we find constant exceptions, a few days more or less than the limit here mentioned being of frequent occurrence, much greater irregularities, indeed, being quite compatible with perfect health. It is by no means rare to find a woman who menstruates once in six weeks or once in a fortnight, without any inconvenience whatever. In all cases, it is the continuance of the flow which mainly determines the duration of the interval or intermenstrual period. In some, and under the influence of morbid conditions, a leucorrhœal discharge takes the place of the ordinary menstrual flow; and, in others, the molimen is relieved by a discharge of a hæmorrhagic nature from some other surface. Both of these conditions, although essentially pathological, are, nevertheless, in not a few instances, beneficial in their action.

Quantity of the Discharge.—The amount of the discharge is very variable, even in the same woman, and very different opinions have been formed as to what is to be considered a normal quantity over the whole period. The obvious difficulties in the way of such an investigation have hitherto prevented anything like a reliable estimate. That of Hippocrates, which we have on the authority of Galen, assumes eighteen ounces to be lost at each period, but this has not been confirmed or supported by any modern observer. Meigs put it down at four to six ounces, and Farre at two to three; and there can be no doubt that these figures give a more accurate idea, and that Farre is probably correct when he says "that a discharge, amounting to six or more ounces in the aggregate, will generally produce for the time sensible effects upon the constitution, such as general pallor, and some feebleness of the muscular system."

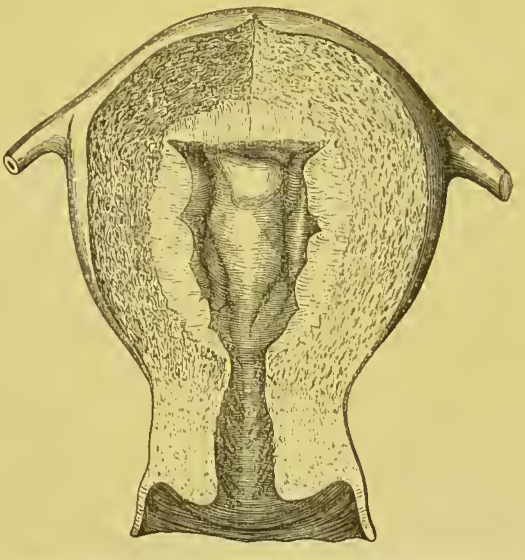
In regard to the nature and influence of the menstrual discharge, very incorrect and even fabulous opinions were entertained. Pliny assures us that the presence of a menstruating woman blights vegetation, turns wine sour, and produces a number of other and similar effects; and in some districts, even at the present day, traces of this superstition are to be found. The peculiar odour, which was described by De Graaf, and which has been compared by some French physiologists to that of the marigold, is a very usual characteristic of the discharge; but it is scarcely necessary to add that, in the absence of any morbid condition, neither this nor any other quality of the discharge can produce deleterious results. During the height of the period, it is composed, as the researches of Donné, Pouchet, Letheby, and others, have abundantly proved, almost entirely of pure blood, mixed with a certain quantity of mucus and epithelial products. During the periods of invasion and decline, the mucus predominates, the colour being in direct proportion to the number of blood corpuscles, which are seen by the microscope, mixed with epithelial scales and with mucous corpuscles from the cervix.

Non-Coagulability.—There is one striking peculiarity which serves to distinguish this from ordinary hæmorrhagic discharges—its want of coagulability. This was at one time supposed to be of itself sufficient evidence that it was not blood, or was blood deprived of its fibrin. The general opinion is that the arrest of coagulation depends upon the mixture of the acid secretion of the vagina with the still fluid blood as it escapes from the os, which not only maintains the fibrin in solution, but also renders it difficult of chemical detection. Later authorities, however, seem to maintain that the cause lies rather in the admixture of mucus with the blood. When the quantity is excessive, constituting the affection known as menorrhagia, nothing is more common than to find clots discharged, the blood being then so far in excess as to neutralize the reagent. It has been asserted that if the blood be collected as it escapes from the os, and before it mixes with the mucus, it is coagulable and alkaline in reaction.

Source of the Menstrual Discharge.—There are few subjects in physiology which have given rise to more discussion than this. Some observers have seen blood oozing from the surface of the vaginal mucous membrane, while others have traced it to the os and cervix uteri; and on isolated observations such as these, theories on the subject have been founded. Admitting the facts upon which these theories have an unsubstantial basis, we recognise in them nothing more than examples of *vicarious* menstruation, a term which has been applied to those cases in which the menstrual molimen is relieved by a discharge through an unwonted channel. That the menstrual discharge has its true source in the mucous membrane which lines the cavity of the uterus is a fact which admits of no doubt, and has been proved to demonstration, by examination of the uteri of women who have died during a period; by accumulation of blood within the cavity in cases of atresia of the cervix or of the vagina; and, finally, by the examination of cases of chronic inversion of the uterus, which offer peculiar facilities for the study of this subject.

In our view of ovulation, those of the essential phenomena of the process which have their seat in the uterus and its lining membrane, were left for consideration at this place. In point of fact, we may assume that menstruation itself is essentially one of these phenomena, which are mutually dependent on each other. Along with the enlargement of the ovary and Fallopian tubes already described, a very considerable enlargement, involving an increase in weight, takes place in the uterus. Its vascular apparatus becomes developed and injected in a marked degree. This is specially obvious in the case of the mucous membrane, on the surface of which, under the epithelium, the vascular network already described becomes very distinct where the vessels surround the orifices of the tubular glands. The glands themselves are also visibly enlarged, and any difficulty which may arise in demonstrating them while the uterus is at rest, now no longer exists. The membrane becomes increased in thickness, its colour is deepened, and the temperature of the whole womb is raised. The result of these changes is that the membrane becomes hypertrophied to such an extent that it is thrown into convolutions, which are soft, pressed together, and project into the cavity so as to fill it completely, its walls being thus no longer smooth but wrinkled. (Fig. 50.) M. Coste, whose conclusions are based upon no inconsiderable number of such observations, says that, save as a pathological product, no such pseudo-membranous exudation exists, as has been described by physiologists of repute.

Fig. 50.



Tumefaction of the Uterine Mucous Membrane during Menstruation. (After Coste.)

A closer examination of the surface shows that, at this period, it is dotted over with minute specks, which a low magnifying power proves to be small drops of blood occupying the orifices of the tubular glands, from which they may be dislodged by gentle compression of the walls. This, however, does not determine the ultimate source of the hæmorrhagic flow, and it is around this part of the subject that the greatest difficulties have arisen.

That it is not a secretion, in the proper acceptation of the term, as was once believed, is a postulate which we cannot hesitate to affirm. We need not therefore address ourselves to the refutation of an exploded theory. The view entertained by Coste is that it is a transudation through the walls of capillary vessels, chiefly venous; or, in other words, (if we do not misunderstand him) that a considerable hæmorrhage takes place in this manner without any breach whatever in the walls even of the smallest vessels, a conclusion which all physiological analogy forbids us to accept. That there may be permanent vascular orifices through which the blood escapes during the menstrual period is an idea which has found favour in the eyes of some eminent physiologists, among others Dr. Farre. Nor is this so fanciful a view as one might be disposed at first to consider it. If there are permanent orifices, it may indeed be asked, why is there not continuous hæmorrhage? And in reply, it may be assumed, hypothetically of course, that these orifices are, during the inter-menstrual period, closed by the contractility of the tissues which surround them, but that the increased vascularity, tumefaction, and relaxation of all these parts, which coincide so constantly with the other phenomena of ovulation, admit of a welling forth of pure blood through apertures which now, under the special circumstances, become patent, and which, the height of the period having passed, forthwith commence to close, to open afresh on the approach of the next menstruation.

Menstrual Decidua.—The theory, however, which perhaps of all others has attracted in recent times the greatest amount of attention, is that which is associated chiefly with the name of M. Pouchet, and to this theory some of the ablest of our English writers have given their adhesion. Pouchet—if we mistake not—supposed that the whole, or at least the greater part of the mucous membrane (not the epithelium merely) is shed at each catamenial period; and that its separation from the subjacent tissues involves the rupture of vessels, whence the menstrual flow. This, however, would involve a very different appearance of the internal surface of the uterus from that which has been above described as occurring at this time, and which we believe to be substantially correct. A separation of a membrane so thick and so important would, in fact, be capable of obvious anatomical demonstration; and if it could be so demonstrated, we would at once have, in the trunks of the vessels which must of necessity be ruptured, the source, clear and unequivocal, which we are endeavouring to trace. The separation of the mucous membrane of the uterus, under the name of *decidua*, which occurs in women at the moment of delivery, and the occasional occurrence of what is known as membranous dysmenorrhœa—when, in certain morbid conditions, the whole membrane is actually exfoliated, and shed either piecemeal or entire,—are facts which have seemed to M. Pouchet sufficient to establish an analogy, on which, mainly, his theory is based. The mucous membrane, he says, is deciduous not merely at the termination of pregnancy, or as a consequence of an exceptional morbid action, but at each menstrual period. No such separation takes place in the lower animals, and in this distinction we find revealed at once the source of the menstrual discharge, and the reason why, in the human species, hæmorrhage is superadded to the ordinary phenomena of "rut." Ingenious as this theory may be, and interesting as the facts undoubtedly are which its promoter has brought to bear upon it, it is one, we think, which requires closer investigation.

If M. Pouchet could show us the exfoliated membrane, and the raw, bleeding surface which its removal necessarily involves, as he might do in membranous dysmenorrhœa, or in women who have died shortly after delivery, his theory would be established, and the question for ever set at rest. But in this he has scarcely succeeded. Opportunities of examining the bodies of women who die during a menstrual period are, no doubt, rare; but a sufficient number of such examinations have been made by Coste, and, more recently, by Kundrat and Engelman, to show what is the usual condition of the parts. In a certain number of cases, no doubt, something approaching to complete exfoliation does occur, but even Pouchet himself is forced to admit that these cases are exceptional. His ultimate conclusion seems to be that the membrane desquamates, not during menstruation, but in the interval. This, however, abandons all the advantage which he gained from the analogy which he so ingeniously established. For there can be no comparison between a desquamation occurring when the functional activity of the womb is in abeyance, and one which is uniformly associated with its highest functions; although an analogy might fairly enough have been traced between the birth of the decidua, in the final act of parturition, and the shedding of the same membrane in connection with a process which is held to be, up to a certain point, preparatory to the reception and development of the ovum.

The separation of the membrane from the subjacent structures would certainly, if occurring during menstruation, account satisfactorily for the discharge; but, even if it were established that an inter-menstrual exfoliation did occur, this would, in no sense whatever, account for the periodical phenomena of menstruation. Dr. Tyler Smith states, that, having had several opportunities of examining the uteri of women who had died during menstruation, he found that the appearances presented were similar to those which are observed after abortion. "In each of those cases," he says, "I found the mucous membrane of the body of the uterus either in a state of dissolution, or entirely wanting." In one case—of which he gives a drawing in his "Manual"—he found that "in the cervical canal the mucous membrane was perfect, but at the os uteri internum it ceased as abruptly as though it had been dissected away with a knife above this point. Blood was oozing at numerous points, from broken vessels in the submucous tissue." In a microscopic examination of this case, in which he was assisted by Dr. Handfield Jones, no traces of the epithelium or tubular glands could be found. Now, if Dr. Tyler Smith founds his belief in the exfoliation theory, on such cases as this, he goes much further than Pouchet himself, in attempting to prove, what that physiologist does not, that the separation of the membrane occurs *during* menstruation. Speaking with that respect for his views to which such an eminent observer is entitled, we are inclined to assume that Dr. Tyler Smith was mistaken, and that the case was either a very exceptional one, or that he mistook shedding of the epithelium for separation of the entire membrane.

We believe that, in all probability, the views of Kölliker, which have been recently, in some degree, confirmed by Robin, point to a more correct conclusion than any of the theories above stated. These distinguished histologists believe, with Coste, that the mucous membrane becomes thickened during menstruation. They hold, however, that the blood escapes from ruptured superficial capillaries, the epithelium covering the mucous membrane being, in great part, thrown off. The interesting observations of Robin, as to the structure of the tubular glands, make it more than likely that a considerable portion of the discharge comes from these; but, that it comes from the surface of the membrane as well, and probably, to a trifling extent, from that of the Fallopian tubes, we may consider as certain. There can be little doubt, however, that a certain change does take place in the epithelium during menstruation. Independent observers have shown, for example, that, as during pregnancy, so also at this time, the epithelium is deprived of its vibratile cilia. Farre has occasionally observed, in an injected uterus, that the capillary vessels, which form so fine a network upon its inner surface, are "denuded, and hanging forth in detached loops." Such observations, taken along with the fact that epithelial cells, and a certain amount of debris, are found mingled with the catamenial discharge, suffice, we think, to prove that, during menstruation, the flow of blood is from the mucous membrane of the cavity, and that certain changes involving the loss of the epithelium, are associated with the flow.

The view above expressed has received recent confirmation from the interesting observations of Kundrat, above referred to. As the result of microscopic researches in the case of women who were menstruating at the time of their death, he concludes that a few days before the menstrual flow is established, a proliferation of the cells of the inter-glandular tissue takes place, by which that portion of the mucous membrane which lies nearest the cavity becomes infiltrated with newly-formed round cells. When the capillary vessels rupture, these cells have already passed through a stage of cloudy swelling and fatty degeneration, and it is this *superficial* portion of the mucous membrane which is thrown off during the continuance of the discharge, and for some days after its cessation. To this extent, then, we hold it to be established that the mucous membrane of the uterus is shed at each menstrual period, and that Pouchet's theory, as corrected by more modern research, is quite in harmony with the facts which nature reveals.[1]

Menstrual Epoch.—The menstrual or child-bearing epoch of a woman's life lasts about thirty years, ceasing most frequently between the ages of forty-five and fifty. So long as the woman enjoys perfect health, the appearance of the discharge should be at regular intervals, of which the normal duration is twenty-eight days. Some women, however, as is well known, menstruate every three or every six weeks, and we are only justified, practically, in looking upon such cases as abnormal, when the general symptoms are such as to call for interference. Irregularities occur, too, as we have already seen, frequently enough during the first months of menstruation; and we find also that, as the limit of this period approaches, the cessation of the menstrual function does not occur abruptly, but after marked premonitory symptoms.

Menopause.—At this period of her life, a woman becomes subject to many hysterical and other minor ailments, from which she may previously have enjoyed an entire immunity. A period may possibly for the first time, pass without discharge. On the next occasion an increased quantity seems as it were to compensate for the omission which nature had made. Intervals of longer duration may now succeed, intervals which bear no relation to former inter-menstrual periods, until, after a certain number of fitful and capricious efforts on the part of the uterus to relieve itself as before, the catamenia finally cease. This constitutes the catamenial climacteric or menopause, after which the uterus becomes less in size, and the ovaries shrink so rapidly, that they become wrinkled on their external surface, so as to resemble, as Raciborski says, the kernel of a peach. As a rule, menstruation ceases during pregnancy and lactation; but to this rule there are exceptions, as we occasionally meet with cases where women continue to have their periods for some time after conception, and not unfrequently, during lactation, menstruation goes on with perfect regularity. Menstrual irregularity, however, occurring during the period of a woman's life which we are here considering, and independent of pregnancy, is generally looked upon as an abnormal state, which calls for treatment with a view to the maintenance of her health. These, and other menstrual disorders, constitute a class of diseases to the treatment of which the physician has constantly to address himself.

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[1] Some of the difficulties which have arisen in the course of the many discussions on this subject are doubtless due to the fact that authorities do not all attach the same meaning to the expression, "mucous membrane of the uterus." Some assume—and we think with justice—that the mucous membrane includes the tubular glands, and all parts lying between the epithelial surface and the proper tissue of the womb. Others again suppose it to include the epithelium only, with the cells immediately beneath it. To the latter the admission of the modern theory of the menstrual decidua can involve no difficulty; but to the former the theory presents difficulties which are due solely to the doubt as to what is meant. No one, we imagine, can now hesitate, in the sense expressed in the text, to subscribe to a theory which has been so carefully and repeatedly demonstrated.

The cause of menstruation is a question which has given rise to a great deal of useless discussion, and to not a few baseless theories. Without broadly asserting that the two phenomena stand to each other in the relation of cause and effect, we are, in the present state of our knowledge, entitled to assume that the periodical discharge depends upon corresponding changes in the ovary, associated with the maturation of a Graafian vesicle. This is proved by the examination of the ovaries of women who have died during menstruation, when the appearances already described are generally to be found; by the almost invariable cessation of menstruation when the ovaries have been removed;[1] and by the facts which a careful examination of the phenomena of the "rut" of the lower animals discloses. Why the act should recur at periods so regular and constant, is a question which we need scarcely attempt to answer. That, in one animal, a single Graafian vesicle should come to maturity each month, in another, a cluster ripen simultaneously, and, in a third, that evolution should occur at intervals of a year, are facts which display a marvellous accordance with the purposes of nature in regard to the propagation of species, but they are facts, the ultimate *cause* of which will continue to baffle the speculation of the astutest intellects.

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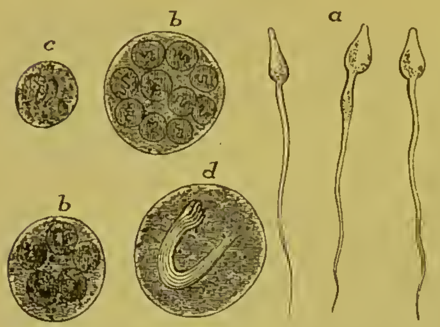
[1] Percival Pott's well known and often quoted case, corroborated by similar observations by Cazeaux, Oldham, and others, was long held as conclusive evidence that menstruation in the absence of the ovaries was impossible. A sufficient number of cases have, however, been reported on good authority to show that, exceptionally, periodic sanguineous discharges may go on in the absence of the ovaries.

Conception, Fecundation, and Impregnation are terms all of which imply fruitful contact of the male and female elements, so that a new organism comes into existence. The fecundating principle which is contributed by the male begins to be secreted by the testes at the age of puberty, and is known as the Semen or Seminal Fluid. At the time of sexual contact, the excitement of the erectile tissue is such, that, acting through the medium of a ganglionic centre, which is supposed to be situated in the lower portion of the spinal cord, it culminates in an orgasm, during which certain muscular fibres are called into a reflex and convulsive action. The semen is thus ejaculated with considerable force by the fibres of the vasa deferentia, and by the special muscles which surround the vesiculæ seminales and the prostate gland, its regurgitation towards the bladder being prevented, according to Kobelt, by the tumefaction of the verumontanum which occurs during the period of erection. It is thus thrown for the most part into the upper part of the vagina, and over the os and vaginal portion of the cervix; but it is well known to medical jurists that this, although highly favourable to impregnation, is not essential. On the contrary, there are perhaps few physicians of experience who have not met with cases where women, believing themselves *safe*, have permitted a certain amount of sexual contact without penetration, and have thus become pregnant. All, in fact, that seems to be essential is contact of the seminal fluid with the pudendum, which is further proved by observations of pregnancy coincident with perfect hymen.

The Semen is a thick, glutinous, whitish fluid, albuminous, heavier than water, and emitting a peculiar odour. If subjected to examination by a considerable magnifying power, it is found to consist of a number of little oval, flattened bodies, which in man are not more than $\frac{1}{6000}$ of an inch in width, furnished with long filiform tails, which taper gradually to the finest point. A lashing undulating motion is imparted to these bodies, for a certain time, varying according to circumstances from several hours to several days, after death or ejaculation. This brisk and constant movement, which has led Kölliker to compare them to ciliated cells, gave rise to the erroneous opinion that they were animalcules—hence the name which they still retain, *Spermatozoa*. Besides these bodies, there are observed certain minute round and granular masses, varying in number, but always fewer in ripe semen than the Spermatozoa themselves. These are what were originally termed by Wagner, "seminal granules," but which have been shown by his subsequent researches, and by those of Kölliker, Leuckart, &c., to be cells within which the Spermatozoa are developed, and are termed *vesicles of evolution.* These again are generally found to be enclosed in groups of from three to seven within parent cells (Fig. 51, *b b*), but each vesicle of evolution is destined for the development of a single spermatozoon, as is shown in a mature specimen at *c*. The individual spermatozoa escape thereafter by rupture of the containing vesicle, and may now (*a*) exhibit their characteristic movements. Sometimes, rupture of the vesicles of evolution takes place without absorption of the parent cell, when the appearance produced is that shown at *d*, where a bundle of spermatozoa is seen, their number corresponding to that of the original vesicles. It is only, it may be observed, by careful examination of the semen in the testes, epididymis, and other portions of the tract, that the several stages may be traced. These elements of the semen are found to float in a limited quantity of clear perfectly homogeneous liquid. Direct experiment on the ova of the Amphibia has proved that it is in the spermatic particles and not in this fluid that the fecundating principle resides. If the spermatozoa are absent, therefore, as in debility, disease, or old age, impregnation is impossible, and it is their absence in the semen of hybrids that renders these animals sterile.

Fig. 51.



Spermatozoa and Vesicles of Evolution.

The Ovum, at the stage at which we left it, was about to escape, or had already escaped, from a ripe Graafian follicle (see Figs. 38, 39, and 40, pp. 73, 74). It is then composed of the following parts :—

a, Of a thick transparent membrane, which completely surrounds it, and exhibits no trace of vascularity—the *zona pellucida* of V. Baer, or *vitelline membrane* of Coste :

b, Of a granular *yolk* contained in this vesicle :

c, Of the *germinal vesicle* of Purkinje :

d, Of the *germinal spot* of Wagner.

The Germinal Vesicle, as the period of dehiscence approaches, moves, as we have seen, towards the periphery of the yolk. Since Bischoff actually demonstrated the presence of spermatozoa on the ovaries of bitches and rabbits, in whom congress has been permitted at the proper period, few physiologists question the possibility of impregnation occurring while the ovum is yet in the ovary; and, indeed, if true ovarian pregnancy is possible, it is only in this way that impregnation can, in these cases, occur. It has been generally assumed, however, that a rupture of the walls of the Graafian vesicle could alone permit of such impregnation; but if we may so far judge from analogy, what has been divulged in reference to the penetration of the walls of blood-vessels by the white corpuscles of the blood, and their subsequent appearance as pus cells, we may at least admit the *possibility* that particles endowed with such mobility may penetrate the attenuated walls of a Graafian vesicle, even before rupture.

In the osseous fishes, and in some animals lower in the scale, it has been shown that a minute opening (*micropyle*) exists in the zona pellucida, which was supposed by Dr. Allen Thomson to facilitate the fecundation of ova possessed of very thick external coverings. No reason other than this exists for the belief, which some have entertained, that a similar aperture in the Mammalia facilitates the introduction of the spermatozoa, but, whether that be the case or not, there can be no doubt that these latter do really penetrate the zona pellucida.

The cessation of the characteristic movements of the spermatozoa marks the termination of the period during which their fertilizing influence may be exercised. The duration of the period will, therefore, obviously depend upon the circumstances under which the semen is placed. Its admixture, at the time of ejaculation, with the prostatic fluid and the secretion of Cowper's glands, and, subsequently, with the vaginal and uterine secretions, are obviously circumstances which tend to preserve the spermatozoa, by furnishing a medium in which they may freely float: an absence of these conditions would necessarily curtail their vitality. Although we may assume it as possible that impregnation *may* occur in the ovary, it by no means follows that it can occur nowhere else. But it is certain that the contact between the male and female elements must almost always take place, if not in the ovary, at some point between it and the upper third of the uterine cavity. Bischoff affirms that, by the time the ovum reaches the lower end of the Fallopian tube, its capacity for impregnation is lost, and experiments which have been made, by tying the Fallopian tubes in the lower animals before copulation, so far corroborate this view, which is now generally entertained. There can at least be little doubt that in the great majority of cases among Mammalia, and most probably in the human subject, it is in the upper half, or third, of the Fallopian tube that the meeting of the ovum with the semen usually takes place.

Progression of the Spermatozoa.—How, then, do the spermatozoa reach the ovum? It cannot for a moment be doubted that the spermatozoa make their way upwards, in Man, as in the lower animals, from the vagina, to that point where they meet the ovum. There are various possible agencies by means of which this movement may be effected:—1st. By the action of the spermatozoa themselves, which may undoubtedly determine a motion, although it is difficult to conceive why such motion should be in a definite direction. 2nd. By the action of the vibratile cilia. This might account, no doubt, for the movement from the middle of the cervix upwards; but in cases where impregnation has resulted from contact without penetration, the absence of cilia between the vulva and the cervix must leave the movement along this part of the tract to the operation of some other agency. 3rd. Muscular peristaltic contractions may also act by propelling the semen in a definite direction. There are various parts of the course which the semen must traverse to which one or other of these forces may be more applicable, but it is more than likely that muscular peristaltic action is one of the moving powers, particularly in the Fallopian tube, although this would seem to point to the conclusion that it must be by an inverted action, seeing that the ovum is propelled in a contrary direction.

The absence of the vibratile cilia during a menstrual period, owing to the shedding of the epithelium and the proliferation of the subjacent cells, may raise a difficulty as to the acceptance of one of the above theories, most likely to suggest itself to those who entertain the strongest views as to the identity of the rut and menstruation. But, in regard to this, it must be observed that the period at which impregnation is most likely to occur, is some days after or shortly before menstruation; in the one case, the changes in the epithelium of the uterine mucous membrane not having yet commenced, and, in the other, a sufficient period having elapsed to admit of its reparation.

A sketch of the development of the ovum, from the period of impregnation onwards, is reserved for the following chapter.

CHAPTER VI.

DEVELOPMENT OF THE OVUM.

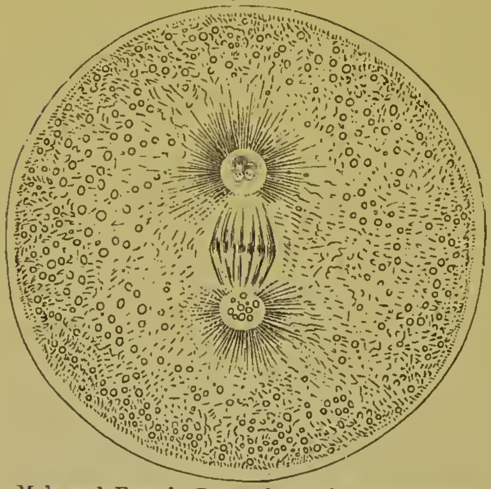
Disappearance of Germinal Vesicle.—Male and Female Pronucleus.—Cleavage of the Yolk.—Development of the Blastodermic Vesicle: its division into Layers.—The Area Germinativa and Primitive Trace.—Formation of the Embryo; of the Umbilical Vesicle and Omphalo-mesenteric Vessels; of the Amnion; of the Allantois and Umbilical Vessels; of the Chorion.—The Liquor Amnii.—The Vitriform Substance.—The Decidua: what is it?—Decidua-Vera; Reflexa; Serotina.—Early connection of Ovum with Decidua.—The Umbilical Cord: Vessels; Gelatine of Wharton, &c.—Knots on Cord.—The Placenta—in Birds: in Non-Placental Mammals: in Ruminants: in Man: Maternal and Fœtal Surfaces of: Maternal Circulation: Curling Arteries: Sinuses: Veins.—Fœtal Portion: Arteries: Tufts or Villi: Veins.—Functions of the Placenta.—Structure of Villi.

THE development of the ovum in the Mammalia, and especially in Man, is, as regards its earlier stages, a subject still involved in no little obscurity. The important results which have sprung from the studies in comparative physiology, associated with the names of V. Baer, Bischoff, Remak, Kölliker, V. Beneden, Balfour, Hertwig, and many others of scarce inferior merit, enable us, with a certain amount of confidence, to fill up gaps in an account of human development, which the very rare opportunities afforded of examining human ova would probably never have revealed, but which the application of strict analogical reasoning enables us to supply. On these principles the following sketch is based. No attempt will, however, be made to follow the development of individual organs; but merely to give a brief sketch of the modern theories as to the impregnation and early development of the ovum, the mode in which the envelopes of the embryo are evolved, and the provision which, in successive stages of growth, is made for its nutrition.

Female Pronucleus.—The disappearance of the germinal vesicle is one of the earliest changes which has been observed. But the disappearance of the vesicle does not involve the loss of all the elements of which it is composed. Its fluid contents are no doubt absorbed, on the rupture of its cell-walls, by the protoplasm which surrounds it, but its more important cell-elements, and especially those of the germinal spot, undergo an elaborate metamorphosis, the issue of which is the formation of the female pronucleus of V. Beneden (the *Eikorn* of Hertwig). It is impossible here to attempt a description in detail of the marvellous changes, including the development of the spindle-shaped bodies and the polar cells, which culminate in the formation of the pronucleus. Suffice it to say that, until this new cell is perfect, the ovum cannot be considered as mature and fit for impregnation. For a complete history of these processes we may refer to the admirable work of Hertwig.[1] The ultimate impregnation is now believed to take place by the penetration into the substance of the yolk of the head of a single spermatozoon. This process too has been traced step by step in many of the lower forms of animal life, and there seems no reason to doubt that in the mammalia the same rules hold good.

Male Pronucleus.—The head of the spermatozoon, detached from its long filamentary appendix, acquires increased vitality on reaching the yolk, and approaches the corresponding female body with great rapidity, and here again fibrillar rays, constituting another spindle-shaped body, are interposed between them (see Fig. 52). Ultimately the two bodies come into contact, and, becoming fused together into one, constitute the first actual union of the elements contributed by the two sexes to which the name of impregnation can with propriety be given. It is interesting to note that the two elements thus united had their origin from simple cells in the Wolffian bodies, and that, while the one element has been elaborated in the testicle, the other has gone through even more complex changes within the ovary, until the moment arrived when they were destined by nature to unite for the fruition of her highest function. A reference at this stage to the accompanying diagram may not be devoid of interest as showing the relation which subsists between the various parts of the genito-urinary

Fig. 52.



Male and Female Pronuclei with the spindle-shaped body between them.

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[1] Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere. Jena, 1886.

organs, in which the primal cells have their origin at an early period of development (see Fig. 53).

Fig. 53.

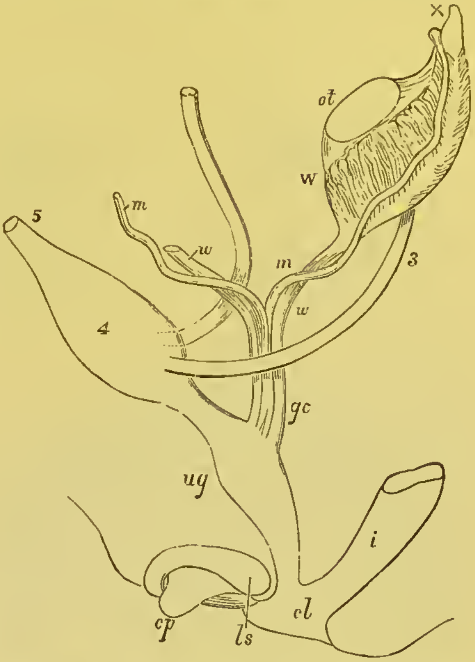
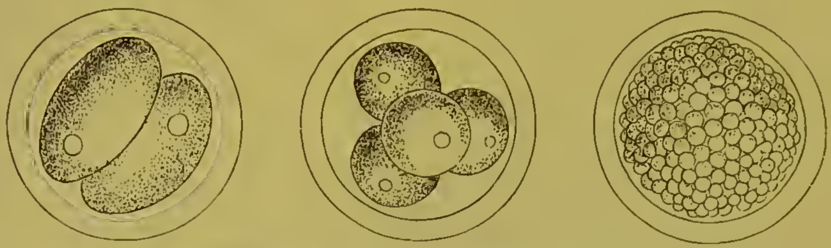


Diagram of the Urino-genital organs of a Mammal at an early date. The parts are seen chiefly in profile, but the Müllerian and Wolffian ducts are seen from the front. 3 Uretor; 4 Urinary bladder; 5 Urachus; *ot* Genital ridge (ovary or testicle); *W* left Wolffian body; *x* part at apex from which *coni vasculosi* are afterwards developed; *w* Wolffian duct; *m* Müllerian duct; *gc* Genital cord consisting of Wolffian and Müllerian duct bound up in a common sheath; *i* Rectum; *ug* Urino-genital sinus; *cp* Elevation which becomes the clitoris or penis; *ls* Ridge from which the labia majora or scrotun are developed. (Allen Thomson.)

On escaping from the ovary, the ovum is still covered with some of the cells in which, within the Graafian vesicle, it was embedded. The yolk becomes more compact, and, as it were, condensed. In the inner half of the Fallopian tube, the cells of the proligerous disc have disappeared, and their place is occupied, on the external surface of the ovum, by a thin albuminous layer, which is analogous to the white of the egg in birds. This albuminous layer grows, in the first instance, thicker, but subsequently becomes gradually thinner, and ultimately disappears, or is incorporated with the subjacent zona pellucida.

Segmentation of Yolk.—There now commences that most remarkable series of changes preparatory to the formation of the embryo, known as the segmentation, or cleavage of the yolk. The first step in this process consists, as is shown in Fig. 54, of the fission of the mass of protoplasmic yolk into two equal portions, by a deep furrow on either side, which ultimately by uniting in the centre, completes the division. These again, by a repetition of the process, become subdivided, so that four spheres are now observed to occupy the cavity of the zona pellucida. After precisely the same fashion, the spherules become still further subdivided into 8, 16, 32, 64, and so on, until, on the arrival of the ovum at the uterine extremity of the Fallopian tube, the yolk presents the appearance shown in Fig. 56, which has been compared to a mulberry. It is to be observed further that a globule or nucleus appears in each of the two original yolk spheres, and that these are reproduced, *pari passu*, in the progress of the segmentation as shown in the figures. Prior to the first cleavage, the vesicular body, which is formed in the yolk by the union of the pronuclei, changes in outline and assumes a shape resembling a dumb-bell, so that, as described by Hertwig, the cleavage is not effected until the two expanded extremities are symmetrically arranged in the yolk. By the absorption of the connecting part one spherule is then found in each section of the divided yolk when the process of segmentation is complete. This process is repeated with each subsequent subdivision, and it is from the mass thus formed that the whole organization of the embryo is gradually evolved. In Mammalia, the process of segmentation affects the whole of the yolk. But there are great differences in this respect in other animals, so that it is necessary to draw a distinction between the ova of animals in which the yolk is entirely segmented, and is therefore germinal, and those in which a part only is directly germinal and another is nutritive. It is also to be noted that the process of segmentation is by no means in all cases so symmetrical as would appear from the above description, and that in many of the lower animals the ultimate cells or segments vary in size.

Fig. 54. Fig. 55. Fig. 56.

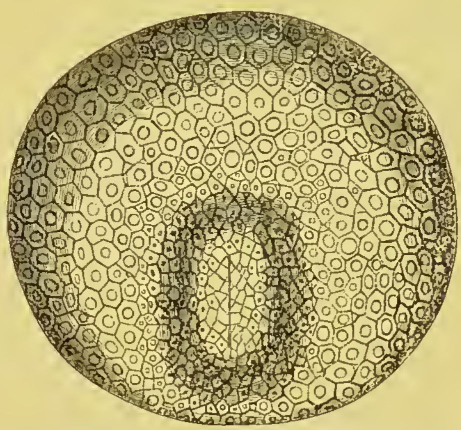


Successive Stages of the Cleavage of the Yolk.

The yolk cleavage sets in within a few hours after the ovum has entered the tube, and the process probably occupies, in the human subject, not less than eight days. This is about the time at which the ovum is supposed to arrive in the uterine cavity, being then, we may suppose, about $\frac{1}{100}$ of an inch in diameter. It now presents an appearance as if the whole of the granular germ-mass had been absorbed. And to some extent, no doubt, a process of solution or absorption has taken place, the centre of the cavity being again occupied by a fluid which is limpid and transparent. A more careful examination shows, however, that a large proportion of the granules become condensed towards the inner surface of the zona pellucida, assuming the form of true cells, of a hexagonal or pentagonal appearance from the pressure which they exercise upon each other, thus forming a new membrane, which completely lines the inner surface of the zona pellucida.

Blastodermic Vesicle.—The spheroidal vesicle thus formed is the structure out of which, step by step, the entire embryonic structures are evolved. This is the *blastoderm* of Pander, or blastodermic vesicle of Bischoff and Coste, and in it changes now take place which are of high physiological interest. We are indebted for the facts upon which the following rapid sketch is based mainly to Hertwig. The illustration which he has chosen, as indicating the manner in which the changes above mentioned take place, is the ovum of the *Amphioxus lanceolatus*, where the blastodermic vesicle consists of a layer of simple nucleated cells. The cells of a portion of the circumference are larger in size, and these he describes as falling inwards towards the original cavity, which thus becomes gradually obliterated. By this process of involution or inversion, the two sides of the originally perfect hollow sphere come into contact, and there are thus formed two layers of the blastoderm, of which the external or *epiblast* consists of the smaller cells, and the *hypoblast* of the internal or larger cells of the original circumference. A new cavity is thus formed, corresponding to the pleuro-abdominal cavity of higher forms, embraced by a double layer and having a temporary orifice. This cavity is called the *Gastrula*, and in some form or other, an analogous process may be traced in all animals higher in the scale. In the Mammalia, the blastodermic vesicle consists at first of a simple hollow sphere with a single layer of cells, but after a time, from the shape of the cells of which it is composed, the ovum comes to present the appearance shown in Fig. 57, which indicates also a considerable increase in size, owing to the rapid augmentation of its fluid contents by absorption.

Fig. 57.

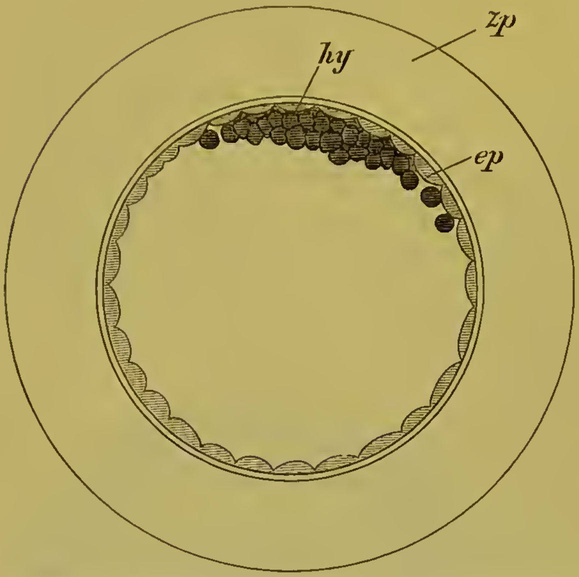


External Surface of the Ovum, showing the Area Germinativa.

Area Germinativa.—At one point of its surface, a certain number of the original cells form, by their aggregation, the appearance which is represented in the same figure. This space, which is at first round, and subsequently becomes oval, is recognised by its whitish opaque appearance. It is called the area germinativa, and constantly increases in size by the development of fresh cells. It is at this stage that the internal layer or hypoblast is first observed. It is then confined to this part of the circumference alone, but at a later stage it spreads over the whole of the internal surface of the ovum.

This is here shown (Fig. 58) where *zp* indicates the zona pellucida, *ep* the epiblast surrounding the cavity, while at *hy* the commencing development of the hypoblast is manifest.

Fig. 58.



Ovum of a Rabbit; 70 to 90 hours after Impregnation. (Balfour, after V. Beneden).

Area Pellucida.—The Area Germinativa, at first homogeneous in appearance, soon shows in its centre a clear space (Fig. 57) called the area pellucida, bounded by a denser layer of cells, which are manifestly more opaque. The first appearance of definite embryonic structure is a shallow groove lying lengthwise in the area pellucida. This is the *primitive trace*, the earliest indication of the cerebro-spinal canal. If viewed in section, this groove (Fig. 59, *a*) is seen to lie between two lateral eminences called the *laminæ dorsales* (*c c*) which we here demonstrate, as it illustrates a law in development, of which, in the evolution of special organs, we find many illustrations. This diagram, after Remak, brings prominently into view a new double layer of the blastodermic vesicle, which from its original relation to the other two, is called the *mesoblast.* In it is shown, at *o*, the site indicating the first trace of the vertebral column, and at *p p* cavities between its two folds mark the origin of the pleuro-peritoneal cavity. The lowest layer in the figure is the *hypoblast.* In the development of the tube of which the groove is the trace, the laminæ dorsales rise and, folding together, meet in the middle line, and there unite.[1] Conse-

Fig. 59.

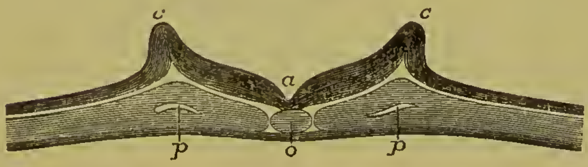


Diagram showing the earliest formation of the Embryo.

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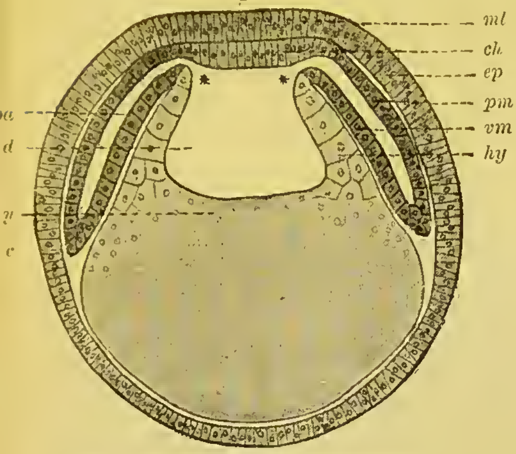
[1] The most recent observations show that this trace or groove is but a temporary arrangement. It appears originally in the narrow or caudal extremity of the area germinativa, but the true medullary groove begins higher up, and growing downwards towards the caudal extremity, replaces as it were the primitive trace.

quently, the cutaneous or corneal layer (*Hornblatt* of Remak) originates on its surface elements which, within the tube, ultimately become the cerebro-spinal nervous centre. Among other instances of this method of development by involution, the formation of the lens and vitreous body, in the construction of the eye, is a striking example, both the cuticle and these structures being originally portions of the same external or corneal surface.

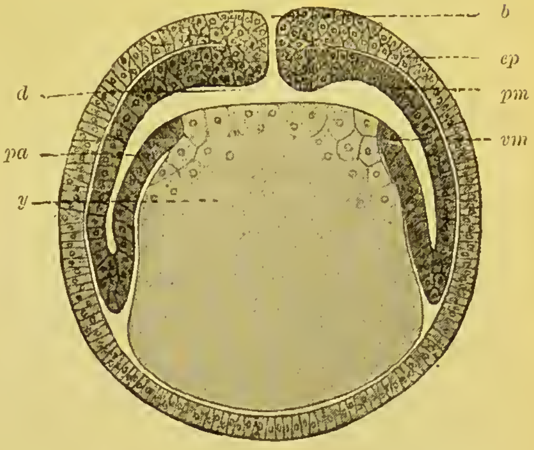
The development of the *mesoblast* involves arrangements too complicated in their nature to be stated at length, but a general idea of the process may be formed by a reference to the accompanying diagrammatic illustrations by Hertwig, where the infolding process, which results in a double layer of mesoblast, is clearly shown.

Fig. 60.



Diagram, showing the development of the two layers of the Mesoblast and of the Pleuro-peritoneal Cavity in the Vertebrata. Transverse section through an Embryo in front of the Blastopore. *ml* Medullary Layer; *ch* Origin of the Chorda Dorsalis; *ep* Epiblast; *pm* Parietal Layer of Mesoblast; *vm* Visceral Layer of Mesoblast; *hy* Hypoblast; *y* Yolk; *c* Yolk-cells; *pa* Pleuro-abdominal Cavity; *d* Primitive Digestive Cavity (Gastrula).

Fig. 61.



Development of Mesoblast and Pleuro-abdominal Cavity in the Vertebrata. Transverse Section through the Blastopore, *b*, which is the Opening from *d*, the Digestive Cavity; *pa* Pleuro-abdominal Cavity; *y* Yolk; *ep* Epiblast; *pm* Parietal Layer of Mesoblast; *vm* Visceral Layer of Mesoblast.

Fig. 62.

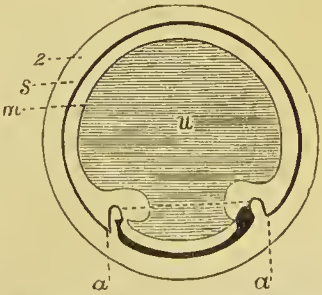
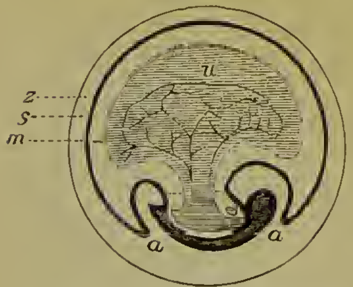


Diagram showing early stage of Development.

The albuminous layer having now disappeared, and the zona pellucida having in great part lost its thickness, the formation of the embryo becomes more distinctly manifested by a rolling or folding inwards both of the sides and of the extremities of the area germinativa. At this stage, the embryo has the appearance of a curved gutter, with a larger (cephalic) and a smaller (caudal) extremity. A glance at the diagram (Fig. 62) will show that its external or epidermic surface is continuous with the epiblast (*s*). About this period, the blastodermic vesicle becomes divided into two parts, as is indicated by the horizontal dotted line in this and the following diagram, the lower portion being *embryonic*, and the large cavity above forming the *umbilical vesicle* (*u*). The embryonic portion constantly increases, while the umbilical vesicle progressively diminishes, as if the development of the former took place at the expense of the latter: this is made clear in the series of diagrams.

Development from Blastodermic Layers.—As it is here impossible to follow in detail the development of individual organs, it may be well shortly to indicate the various parts which spring from the layers above described. From the external layer or hypoblast is formed the epidermis with all its appendages. By a process of inclusion, the brain and spinal cord are also developed from its surface, while the principal parts of the eye, ear, and nose are formed by a similar process; and it plays further an important part, as we shall see, in the development of the inner fœtal envelopes. The hypoblast forms the whole epithelial lining of the alimentary canal and of the glands connected with it, with the exception of the mouth, the lining of which, for some distance, is furnished by the outer layer. It also lines the bronchi and lungs, and furnishes the inner layer of the allantois and umbilical vesicle. The mesoblast is closely connected, by its outer layer, with the epiblast, and, by its inner layer, with the hypoblast, so that its ultimate anatomical relations are somewhat obscure. From it undoubtedly proceed all the parts of the skeleton, the muscles, fasciæ, and tendons, the outer coats of the alimentary canal, the parenchyma of many glands, and the urinary and reproductive organs. It also forms the outer layer of the allantois and umbilical vesicle, and, ultimately, contributes to the formation of the fœtal part of the placenta.

Fig. 63.



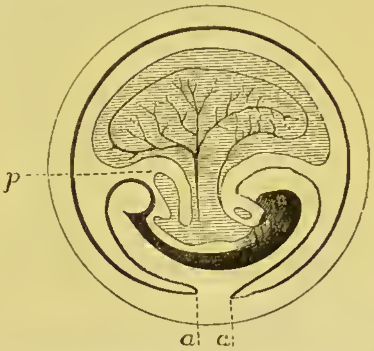
Further Development of the Ovum.

Amnion.—The two small projections (*a a*) in Fig. 62 show the earliest stage of the formation, by a process of involution, of the amnion, an important structure, the further development of which will be traced presently. The blastodermic vesicle, then, is surrounded by the zona pellucida (*z*). It is at first composed of two layers, the external layer or epiblast (*s*), which is continuous with the external surface of the embryo, and from which the amnion is mainly developed; and the internal layer or hypoblast (*m*), from which the mesoblast is subsequently developed within the embryo. If we look, however, at the hypoblast, in its original and simplest form, we observe that the umbilical vesicle and the intestinal surface of the embryo are identical and continuous, both being lined by the same layer.

In Fig. 63, the same parts are shown in a more advanced stage of development. The embryonic portion of the blastodermic vesicle is more defined, and of larger size, and the umbilical vesicle is diminished in a corresponding degree, while the communication between the two is rendered more distinct. The first indications are now shown on the latter of a vascular system. This is the *omphalo-mesenteric* system, or circulation of the yolk, from which is formed ultimately the portal circulation of the fœtus. The umbilical vessels spring, as we shall see, from another source. The amnionic folds (*a a*) are now seen to project more over the embryo.

Allantois.—The next step in the process of development is indicated in Fig. 64, in which the whole ovum shows an increase in size. The amnionic folds project so far that they are nearly in contact, the embryo being thus enclosed in a sac, which has as yet an opening at (*a a*). About this period, a very important structure, the allantois, makes its first appearance under the form of a small pear-shaped vesicle (*p*), which springs from the mesoblast and hypoblast, near the caudal extremity of the embryo. This little organ has, as we shall find, a most important part to play in providing an apparatus, and channel of communication, whereby the circulation and respiration of the fœtus may be efficiently maintained. This vesicle, in Birds, reaches a very considerable size, so much so as completely to surround the yolk sac, so that, through the shell and its membrane, it comes into actual relation with the external air. In those mammals, in whom the placenta (an organ to be hereafter described) surrounds the ovum, the allantois has in like manner a considerable development; but, in the human race, where its function, though not less important, may be said to be comparatively of a temporary nature, the allantois never reaches any considerable size. It is originally hollow, and is the receptacle for the secretion of the Wolffian bodies, and subsequently for that of the true kidneys when formed. It is not, however, correct to suppose that it gives origin to the urinary bladder, but its pedicle,

Fig. 64.

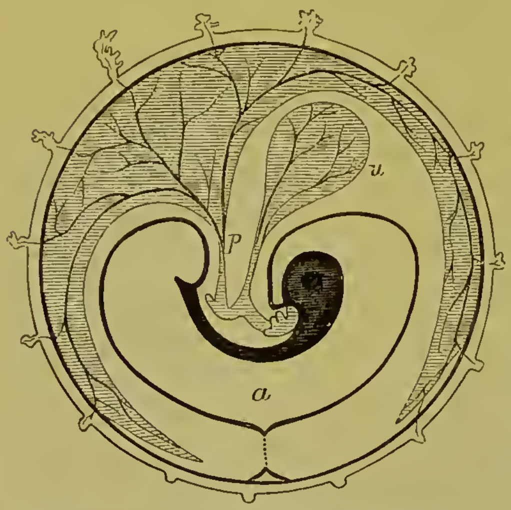


Development in a more advanced Stage.

the *urachus*, forms the suspensory ligament of the bladder, and may be traced in adult life. At a very early period of its formation, vessels make their appearance upon it, and shortly after this (probably in a few days) it becomes elongated and, as it were, *projects* these vessels, which are the umbilical arteries and veins, towards the surface of the ovum, with which it comes into contact at that part where the placenta is ultimately formed. It is not until this has taken place that the outer of the two fœtal envelopes may properly be said to be completed.

Chorion.—The fœtal covering here alluded to is the chorion, which may thus be considered as composed of the epiblast, or serous layer, as it was at one time called, with the remains—should these still exist—of the zona pellucida on its external, and some portions of the allantois on its internal surface. The chorion, thus constituted, becomes abundantly supplied with vessels from the allantois, which soon pervade it in its whole extent, as is shown in the accompanying diagram (Fig. 65). Prior to this, small projections have appeared on the external surface of the chorion (*prochorion*) which are the rudiments of the long shaggy *villi* with which the ovum is seen to be covered in abortions occurring in the early weeks of pregnancy. The allantois, having now fulfilled its function, dwindles to a mere cord, within which a minute vesicle may be detected by careful examination, as representing the original cavity. It is probable that the allantois forms about the tenth day after impregnation, and runs its course in a few days more; so that it is not to be wondered at that some of the earlier observers doubted its existence in the human race, seeing that its limits have not yet been clearly demonstrated. Analogy, however, enables us confidently to assume that, without it, there could be no vascularity of the chorion, a condition which would involve a speedy arrest of development. At first, it carries two arteries and two veins; but the vein of the right side becomes obliterated about the fifth or sixth week, so that there are found, from this period till the time of birth, two umbilical arteries and one umbilical vein.

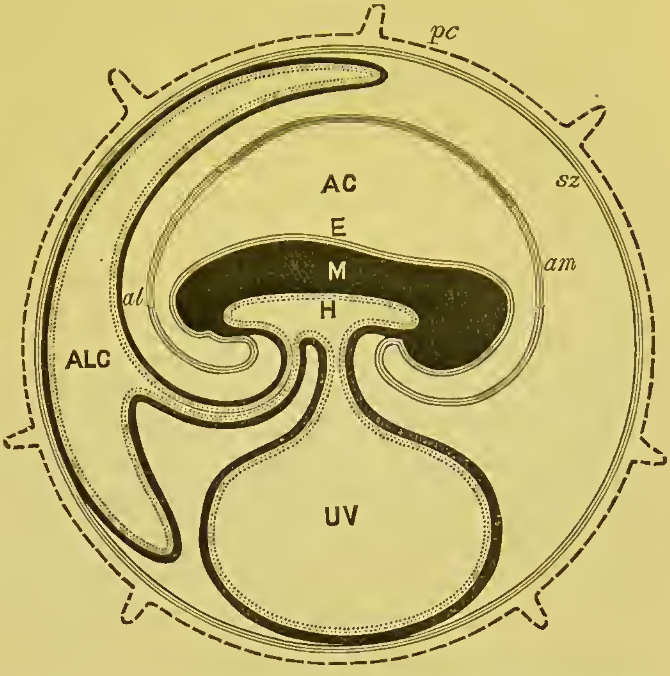
Fig. 65.



Completion of the Amnion, and formation of the Umbilical Cord.

The processes here described are represented with greater completeness in Fig. 66, inasmuch as the mesoblast is represented as well as the outer and inner layers of the original blastodermic vesicle. The dark shading indicates the mesoblast, and thus is shown its connection with the outer layer, both of the umbilical vesicle and the allantois. In like manner is indicated the continuity between the hypoblast of the embryo and the lining membrane or inner layer of the same structures.

Fig. 66



Diagram, showing the Embryonic Envelopes in a Mammal; *pc*, Zona Pellucida, with rudimentary Villi (*prochorion*); *sz*, Serous Membrane (Epiblast); *am*, Amnion; *AC*, Amnionic Cavity; *M*, Mesoblast of the Embryo; *H*, Hypoblast of Embryo; *UV*, Umbilical Vesicle; *ALC*, Cavity of Allantois; *al*, Allantois. (Turner.)

After the formation of the allantois, the umbilical vesicle rapidly shrinks, and is often seen, in abortions at the sixth week, under the form of a vesicle no larger than a pea, connected with the small intestine of the embryo by means of a long and narrow pedicle; and its flattened yellowish vestige may with care be detected much later, lying not far from the place of implantation of the umbilical cord into the placenta, between the chorion and amnion. (See Fig. 65.) The omphalo-mesenteric vessels atrophy, along with the organ to which they belong; and the communication which existed between the vesicle and the alimentary canal becomes more and more curtailed, and ultimately obliterated. There can be no doubt, however, that in the earliest stages of the development of the ovum, and up to the period of the formation of the allantois, the embryo derives nourishment from the whitish-yellow fluid which is contained in the umbilical vesicle, and which, although much less rich in nutritive elements than the yolk of birds and reptiles, has been found to contain numerous fatty cells and globules. But with the formation of the allantois and the vascularity of the chorion, the necessity for nutrition from this source ceases, and the umbilical vesicle, which at one time formed the greater part of the bulk of the ovum, now withers, and ultimately disappears.

At the same time that this dwindling of the umbilical vessel takes place, the development of the amnion goes on with considerable rapidity. In Fig. 65 the completed process of involution, which results in the formation of the cavity of the amnion, is shown, as are the earlier stages in the preceding diagrams. The amnion thus forms a close cavity or sac, which consists of two layers, and is contractile; and in which, henceforth, the fœtus floats freely, protected by the fluid which it contains from shock and external influences. By the absorption of the original amnionic folds at the point where they come into contact (see the dotted line below *a*), the amnion becomes completely detached from that portion of the epiblast which we have shown to enter into the formation of the chorion. The amnion thus forms a sheath for the umbilical cord, and from the margins of the ventral aperture or umbilicus is continuous, as it has been from the first, with the surface of the embryo. When completed, it constitutes the internal envelope of the ovum; and from its inner surface there exudes a liquid (*liquor amnii*) which is essential to the safety and further development of the embryo,—not by affording it nourishment to any extent, but by the mechanical support and protection which it constantly maintains. The liquid consists of water, holding in solution a small quantity of albumen and salts. It is at first limpid, but, towards the end of pregnancy, it becomes of a higher specific gravity, and is often milky, or of a darker colour, with numerous albuminous flakes. When the hue is greenish, or dark in shade, this is probably due to the escape of the contents of the bowel. The quantity of the liquid varies extremely, and that, too, without apparent cause; and, while its actual quantity may be said to augment during the whole period of gestation, it is generally admitted that, relatively to the size of the fœtus, it increases during the first half of pregnancy, and diminishes from that time onwards. In addition to the protection of the fœtus from shock, which must manifestly be exercised to the greatest advantage during the early months, the liquor amnii gives room for the movements of the fœtus, which we cannot doubt to be essential to its proper development, and for changes in position or posture, in obedience to the laws of gravity. It protects, also, the umbilical cord from pressure; and, during labour, prevents the walls of the contracting uterus from pressing prematurely on the surface of the child, while it safely and expeditiously effects the mechanical dilatation of the os. Finally, omitting, for the present, the possibility of its being a source of nutriment, it is of great assistance to the accoucheur,—preventing the firm contraction of the uterus upon the child, and so facilitating, in many ways, both manual and instrumental operations.

Vitriform Substance.—External to the amnion, the interval between it and the chorion is occupied by a soft gelatinous material, to which Velpeau gave the name of vitriform substance; and embedded in which are the remains of the umbilical vesicle. The long pedicle of the umbilical vesicle penetrates the cord by an aperture in its sheath. The closure of the amnionic cavity, the formation of the allantois, and the connection thus ultimately established between the embryo and the exterior of the ovum, complete the essential parts of the ovum. The latter now consists—

a. Of the Embryo:

b. Of the Liquor Amnii, in which it is suspended:

c. Of the membrane of the Amnion; which is the internal envelope of the ovum, is continuous with the external surface of the embryo, and forms a sheath to the umbilical cord: the pedicle of the umbilical vesicle passes through an aperture in this sheath:

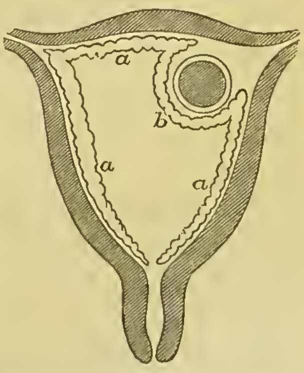
d. Of the Urachus or pedicle of the allantois, and other parts which, together, form the Umbilical Cord:

e. Of the Chorion,—the external envelope of the ovum.

These parts, although deriving, no doubt, the supply of material necessary for their growth from the parent, are strictly of embryonic origin, or spring from parts which take their rise in connection with the embryo or the peripheral membranes of the ovum. Other structures, however, are simultaneously developed, which may be regarded as in whole or in part maternal.

The Decidua.—The outermost of the three coverings of the ovum, one which, according to every hypothesis hitherto advanced, must be looked upon as purely maternal in its origin, is the decidua. The theory originally propounded by Hunter, and adopted by the great bulk of physiologists of the early part of the present century was simply this:—The congestion and excitement coincident with impregnation caused, on the inner surface of the uterus, an exudation of a new formation of the nature of coagulable lymph, which closed the orifices of the Fallopian tubes, leaving only one opening, corresponding to the internal os. The ovum, on its arrival in the uterine cavity, was assumed to push this membrane before it, so that the decidua became

Fig. 67.



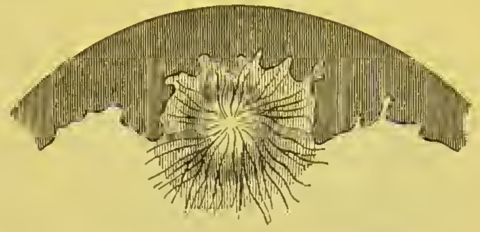
Diagram, showing Hunter's theory as to the formation of Decidua.

naturally divided into two parts, that which adhered to the uterine surface (*decidua vera*, *a*,), and that which invested the ovum (*decidua reflexa*, *b*). Subsequent observation having shown that a portion of membrane, identical in its structure with these, was found behind the ovum,—between it and the uterine wall,—this was regarded as a formation subsequent to the arrival of the ovum, and was named the *decidua serotina*. This theory owed its general acceptance to the fact, that it afforded an explanation of what had frequently been observed in abortions—that the complete ovum was found to be enclosed in a pouch, which was shed from the uterus, and which thus derived its name. The view universally adopted by modern physiologists is, however, quite different from this.

We have already seen in our notice of the mucous membrane of the uterus, as observed in women who have died during menstruation, that it is at these periods greatly hypertrophied and congested, and, in consequence, thrown into convolutions. (See Fig. 50.) Up to a certain point, the changes after impregnation are identical with those which accompany the menstrual molimen. According to Robin, the columnar and ciliated epithelium is partly exchanged, during the progress of pregnancy, for the tessellated variety, and partly desquamated. Sharpey and Weber found that the decidua vera was, allowing for the changes above mentioned, identical in structure with the mucous membrane of the uterus; and, especially, that the characteristic tubular glands were abundant, and much more distinct than in the unimpregnated condition. By others, the orifices of the Fallopian tubes were found to be free. As regards the decidua reflexa, greater difficulties had to be surmounted. If this portion of the membrane be examined at an advanced period of pregnancy, it is found to be thin and transparent, if indeed it can be separated from the decidua vera; and it then presents no trace whatever of the tubular glands. At an earlier period, the glands are found to be absent in the central or more prominent portion only, becoming more distinct, however, as we approach its point of contact with the decidua vera. In fact, we may assume, with Coste, that the views of Bischoff are, on this subject, incorrect, and that, on its first formation, the decidua reflexa is identical in its structure with the decidua vera. All this points irresistibly to the conclusion that the decidua is nothing else than the uterine mucous membrane, altered to suit the requirements of the case.

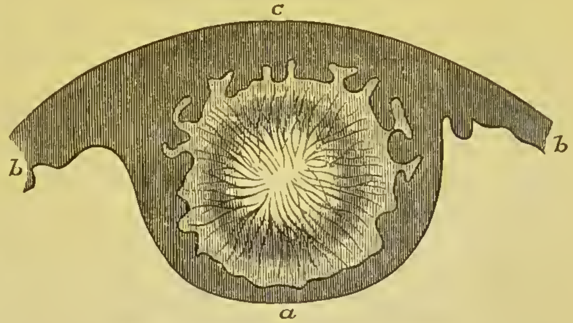
The main difficulty which, on this view, will suggest itself to the student, is to account for the manner in which the ovum becomes surrounded by the mucous membrane. Here we must be content with theory; but it is a theory founded directly on the facts which modern physiology has revealed, and certainly preferable to that of Hunter, more especially as accounting for the existence of the decidua serotina. The ovum, on its arrival in the uterine cavity, is for a certain time free from all adhesion. Probably, it becomes arrested in one of the sulci between the convolutions into which the mucous membrane is thrown, and there it contracts adhesions, at the point where the placenta will presently be formed. On either side of it there now rise projections of the mucous membrane (Fig. 68), as we have seen to occur in the formation of the amnion and in that of the organs of special sense: the folds meet in the centre, and the evolution is complete, *a* (Fig. 69), being the *decidua reflexa*, *b*, the *decidua vera*, and *c*, the *decidua serotina.* The villi, which at this time are abundantly developed on the surface of the chorion, were assumed by some to be received into the orifices of the uterine glands, and, indeed, Sharpey actually found this to take place in the case of the bitch. The simple fact of extra-uterine pregnancy seems, however, sufficient to show that, although this may occur, it is by no means essential as a step in development. But, whatever view we may be inclined to take of the theory, the facts are these: if we open the uterus of a woman about the fifth week of pregnancy, we find, almost certainly, a tumour in the neighbourhood of the fundus, and projecting into the cavity of the uterus. The Fallopian tubes are open, and the membrane which covers the tumour is continuous, and identical in structure, with that which lines the uterine cavity, the glands being probably more distinct near its base. The tumour, on being incised, discloses a cavity containing an ovum. All this seems to indicate that the modern theory is, in the main, more correct than any hitherto advanced.

Fig. 68.



Formation of Decidua: first stage.

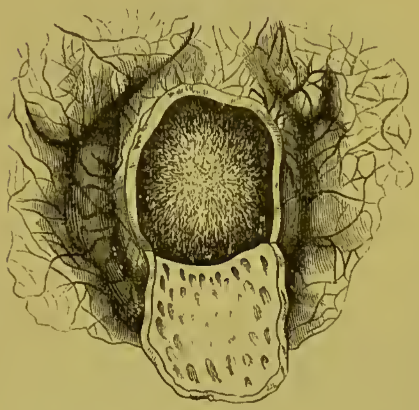
Fig. 69



Formation of Decidua completed.

If, in the course of such an examination as has just been indicated, the cavity be carefully opened, and a flap turned down, the ovum, quite uninjured, may then be observed, sometimes bathed in blood when blood-vessels have been injured. Its external surface will be seen, bristling with villi, and on the inner surface of the everted flap, small depressions or lacunæ may be noticed, into which the villi dip, and by means of which, no doubt, material is obtained for the time from the circulation of the mother. If, again, we cautiously remove the ovum and wash out the cavity, we shall find that the lacunæ on the side of the decidua serotina are much deeper and more numerous. This marks the place at which the placenta is about to form.

Fig. 70



Flap of Decidua Reflexa turned down, disclosing the Ovum.

If we look again at Fig. 70, we may observe that in the most projecting part of the ovum, which is the centre of the everted flap, the membrane has become thin and exsanguine; and here, even at this early period, we would probably look in vain for the tubular glands. This is the commencement of another and an important change which goes on, *pari passu*, with the development of the placenta. Those villi of the chorion which pass towards the decidua serotina are more and more developed, and become embedded in the latter, the two together forming the placenta, an organ to be immediately described. So soon as this new connection is thoroughly established, the villi over the remaining surface of the ovum diminish, or cease to grow in the same proportion; and, as the ovum extends, they become thin and scattered over that side of the chorion which is most distant from the placenta, and are ultimately absorbed, the external surface of the chorion being then perfectly smooth. With this, the decidua reflexa loses its vascularity, the vessels becoming obliterated from the centre of the projecting part towards the circumference. As development progresses, the ovum steadily increases in size, and the cavity which exists between the two layers of decidua becomes, in consequence of this, encroached upon, until, about the third month, the two come into contact, and the whole of the uterine cavity is then occupied by the fœtus and its membranes. It is impossible after this stage to distinguish or separate the decidua vera from the decidua reflexa, which has led Dr. A. Farre to think it probable that the decidua reflexa, after becoming extremely attenuated, ultimately disappears entirely.

The Umbilical Cord.—Let us now turn again to the interior of the ovum, the essential parts of which were completed by the formation of the allantois. The elongation of the pedicle of the allantois, and the obliteration of its cavity take place with great rapidity, and, at the same time, the cord becomes very considerably increased in length. From this period onwards, the Umbilical Cord consists of the following parts:—the amnionic sheath, which entirely surrounds it, save at one point, where a small slit gives egress to the pedicle of the shrunken umbilical vesicle; the two umbilical arteries and the umbilical vein, which form the greater portion of the bulk of the cord; that portion of the pedicle of the umbilical vesicle, which extends from the umbilicus to the point of exit; and lastly, the remains of the pedicle of the allantois. By means of the villi of the chorion, acting, as Professor Owen has observed, like the spongioles of a plant, nutriment is extracted from the maternal soil in which it is embedded, each vascular tuft being, as it were, an independent centre of respiration and nutrition. But, with the complete establishment of the umbilical communication—for it cannot as yet be termed a "cord"—these functions become localized in the human race, and there now begins to form, at the point, probably, where the allantois first touched the wall of the ovum, an important special organ of connection, the *Placenta*, in which externally the umbilical cord terminates. The Umbilical Cord, being composed of the elements above detailed, conducts the fœtal blood from the bifurcation of the abdominal aorta to the placenta by its two arteries, and brings back the same blood by means of its single vein, it having meanwhile undergone certain changes. The obliteration of the umbilical vesicle soon admits of the closure of the aperture alluded to, and thus reduces the contents of the cord to the vessels above mentioned, and the loop of bowel which still protrudes by the umbilical orifice. This communication between child and placenta varies considerably in length. At first, it is short, and is also thick in proportion to the size of the ventral aperture, but soon it becomes considerably elongated. Even at the termination of pregnancy, however, great varieties are observed, it being in some instances no more than a few inches in length, and in others extending to five feet or even more. Its average length, at the full time, may be assumed to be somewhere about twenty inches. The vessels, which are devoid of valves, and which give off no branches in the cord, are disposed in regard to each other, in a manner somewhat peculiar. Firmly bound together by a tenacious substance called the gelatine of Wharton, the quantity of which determines in a great measure the thickness of the cord, the vessels are invariably twisted like the handle of a basket. This does not take place in an irregular manner; on the contrary the twist is, nine times out of ten, from right to left, and, invariably, the vein forms as it were a centre or axis, around which the arteries are arranged in an irregularly spiral form. This twisting, which has been observed as early as the second month, is supposed to depend partly upon the movements of the fœtus, and partly upon a more rapid growth of the arteries than of the other tissues of the cord. On an average, the cord is about the thickness of the little finger. Many anomalies have been observed in its formation. One artery, three arteries, and even three veins have been met with, without anything untoward having occurred in the course of pregnancy.

When the cord is too long, knots have frequently been observed upon it. These are, doubtless, due to the movements of the fœtus, and are much more likely to occur if, along with great length of the cord, there is an excess of the liquor amnii. It is easy to understand how, under such circumstances, the fœtus might float through a large loop, and a knot be the immediate or ultimate result. It is conceivable that danger might arise from this, in the course of labour, should any mechanical complication tend to draw the knot tighter; but all experience seems to show that these knots are not to be looked upon as dangers, unless under such very exceptional circumstances.

The cord is, as a general rule, of very considerable strength, as is shown in cases where—mostly in error—considerable force is brought to bear upon it, in attempts to remove the placenta when this organ is retained. At other times, a very moderate tension will suffice to break it. It is firmly adherent, at its fœtal extremity, to the abdominal walls of the child, and, at the placenta, it is found to be intimately connected with the tissues of the chorion. Externally, its connection with the amnionic sheath is of a slighter character, and this is more particularly to be observed near the placenta, where the amnion often passes off from it near to the point of its insertion, and thus forms a sort of infundibuliform investment, which has been noticed by many authors. Nerves and lymphatics have been described as appertaining to the umbilical cord, but these, if present, are so difficult to trace that their existence is very generally doubted.

The Placenta.—The ovum is, as we have seen, supplied with nutriment, in the first instance, directly from the contents of the umbilical vesicle, through the channel of communication which exists between it and the intestinal canal; subsequently, in all probability, through the medium of the omphalo-mesenteric circulation; and, at a still later period, before the formation of the allantois, through the villi of the chorion, by imbibition. When, through the agency of the allantois, the umbilical vessels have been projected to the walls of the ovum, a more direct means of communication is at once established. In the lowest Mammalia, which are hence called "non-placental," no further change takes place in this respect—the whole periphery of the chorion exchanging elements with the maternal parts, as in the early human ovum,—until the period of birth. In many of the higher Mammalia, as in the Ruminants, certain portions of the surface of the ovum contract with the super-imposed maternal parts more intimate adhesions, while other parts become, in comparison, more deprived of their villi. An increase of tissue at these points gives rise to the formation of "cotyledons," which may be looked upon as so many miniature placentæ, the structure forming the cotyledons being in those animals permanent. Many other and interesting varieties are observed, among which we may mention the diffused placenta of the mare and pig, and the zonal placenta of the Carnivora. In man, however, and the higher orders, the mass is confluent and concentrated at one spot, and thus forms the single connective organ which is known as the Placenta.

The disappearance of the villi over the remaining portion of the surface of the chorion, concentrates within the new organ the functions of nutrition and respiration, which it has thenceforth to discharge. A study of its structure is of peculiar interest to the obstetrician, as any diseased or other condition which may affect the due performance of its functions, must necessarily exercise an important influence on the healthy and normal development of the embryo. In many of the animals in whom a placenta exists, that portion which is derived from the ovum may be readily separated from the part which is of maternal origin; but, in the human placenta, no such separation is in any way possible, so intimately are the two elements incorporated together. We must, nevertheless, look upon the placenta as composed originally of two distinct parts or layers, which are accordingly named the *maternal* and *fœtal* portions of the placenta.

The maternal portion is developed out of that part of the uterine mucous membrane to which the ovum attached itself on its arrival in the uterus. In other words, it is the decidua serotina. No sooner has its formation commenced, than the blood-vessels in the corresponding region of the uterus become notably enlarged, the arteries retaining their characteristic spiral form, while the diameter of the venous trunks becomes so much increased, that they are now called sinuses. In the earlier stages of formation, the maternal and fœtal vessels are easily seen to run in distinct structures, which may be separated artificially from one another, without rupture of any of the vessels. But, as the placenta becomes more consolidated, the interweaving of the two sets of structures becomes more intimate, by the thinning out of the intervening material, while the villous ramification of the fœtal part, becoming more and more extended, is accompanied by a corresponding inflection of the maternal structure and vessels over every part of the villous surface; so that, at last, there is produced so complete a combination or interlacing of the two as to make it quite impossible to separate them, or even to distinguish accurately the confines between the structure which was originally fœtal and villous, and that which was maternal or decidual. Numerous observations have proved this, but none more distinctly than the experiments of Bonami, to which we shall immediately refer. Before doing so, however, it is necessary to observe that, on separating a placenta from its uterine attachment by cautiously drawing the parts asunder, it becomes obvious that a special tissue intervenes. This has been described as separating into two thin gelatinous layers, consisting, when *in situ*, of interlacing lamellæ, adhering at certain points only of their surface, and thus forming intervals which may be shown on gently drawing the parts asunder. This is the *utero-placental* tissue.

Structure of the Placenta.—Bonami demonstrated so far the structure of the placenta by coloured injections as follows:—He injected—

1st *Red*, from the iliac and ovarian veins:

2nd *Blue*, from the uterine arteries:

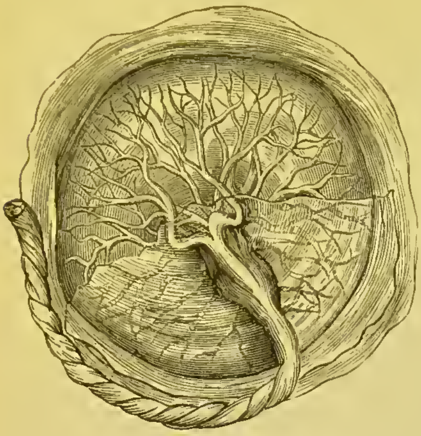
3rd *White*, from the umbilical vein:

4th *Yellow*, from one umbilical artery, the other being tied to prevent the regurgitation, which from the anastomosis, would otherwise have occurred.

Careful observation and dissection then disclosed the following facts: that numerous *red* vessels were visible through the amnion on the fœtal surface of the placenta; that *red* and *blue* vessels, the former straight and the latter spiral, were seen to pass in great numbers through the *utero-placental* tissue, and to penetrate the placenta; and, finally, that a *white* and *yellow* net work was distinctly seen on the uterine surface of the placenta. As no escape of the injected fluids had taken place into the intermediate tissues, the facts speak for themselves.

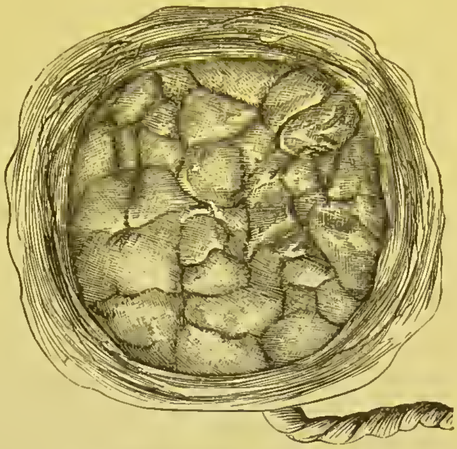
Before proceeding to consider the more minute structure of the placenta, some general description of the physical characters of the mature organ may here be given. On its removal from the body, it is found to be a soft spongy mass, about twenty ounces in weight, and seven and a half inches in its greatest width. These are, of course, average dimensions, as it varies greatly in size; and, on the same principle, it is described as being three fourths of an inch thick in the centre, and one eighth to one fourth of an inch at the margin. It is circular or slightly oval in form, and the umbilical cord is inserted in the centre of its fœtal surface. It may be situated at any portion of the uterine surface, even over the os, but its usual site is the neighbourhood of the fundus. It presents for observation an internal or fœtal, and an external or uterine surface.

Fig. 71.



Fœtal Surface of the Placenta.

Fig. 72.



Maternal Surface of the Placenta.

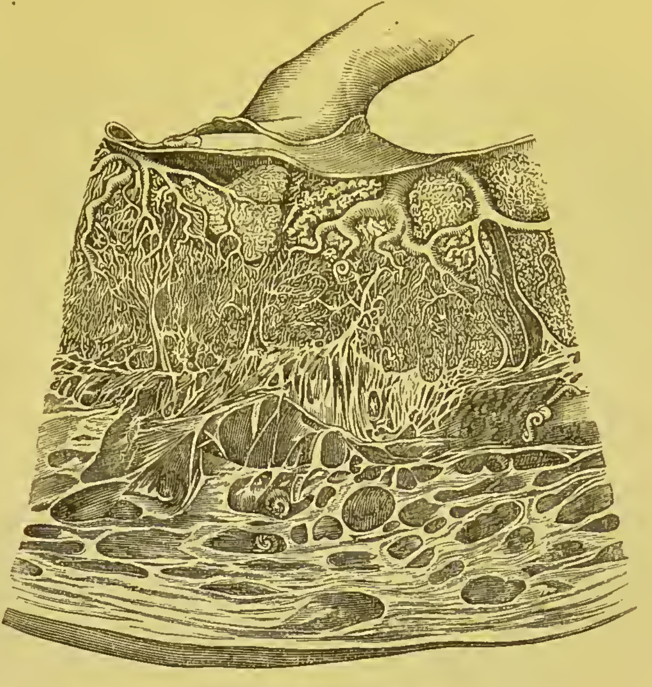
The internal or fœtal surface (Fig. 71) is smooth, and is covered by the amnion, through which the vessels are distinctly seen to divide and sub-divide before plunging into the tissue beneath. The external or uterine surface (Fig. 72) is very different from the former. It is slightly rough on the surface, giving a peculiar granular impression to the finger, very familiar to every obstetrician. It is, moreover, divided into irregular lobes, which may be easily torn or separated from each other. Indeed, examined from this side, the substance of the placenta may be said to be brittle. This surface is covered, as has been shown, by a thin layer of utero-placental tissue, through which, with some care, and by floating the placenta in water, the oblique passage of the veins from the uterus may be detected. The margin is continuous throughout with the membranes; the fœtal portion with the chorion, and the maternal with the decidua.

Peculiarities in the structure of the placenta, and in the manner of its connection with the umbilical cord, are not very uncommon. What is known as "battledore placenta" is one of the most common of these, the cord being then attached, not to the centre, but to the margin of the placenta, giving it something of the form from which it has derived its name. In other cases, although much more rarely, small lobes or cotyledons are found detached from the general mass, as in a case figured by Dubois; while in twin cases certain modifications are observed which are essential to the dual development, but which will fall more naturally to be considered under the section relating to plural pregnancy.

The structure of the placenta being thus complicated, it is not to be wondered at, that great difficulties have been encountered in determining what is the nature of the communication which there takes place between the fœtal and maternal circulating systems. An opinion long obtained that there was a direct commingling of the two currents, and that blood passed from the uterine arteries directly to the fœtus, and, after there yielding a portion of its vital constituents, returned again by the uterine veins. The earliest attempts at injection, being no doubt unskilfully executed, seem to have encouraged this belief. Modern physiologists have long since dispelled this illusion, and the experiments of Bonami above cited demonstrate, along with others, that there is a maternal and a fœtal circulation, each being distinct from the other as regards continuity of current down to its uttermost conduits. The vessels of the two systems are, however, in intimate contact throughout, as is made obvious at once by anatomical demonstration, and by a knowledge of the physiological necessities of the case. What, then, is the nature of the contact which permits of an interchange of material between the two?

Circulation in the Placenta.—In attempting to answer this question, and to describe the minute structure of the placenta, it must be admitted that there are still many points in regard to which differences of opinion exist, and some difficulties which have yet to be explained. To enter upon a full consideration of these would ill accord with the expressed object of this work, but a general view of the case, as adopted by the best authorities, may here be briefly epitomized. The vessels which are seen to pass through the utero-placental tissue are, with an important exception to be noticed afterwards, of two kinds, arteries and veins. The former, the "curling arteries" of the uterus, as they are generally called, are of moderate size; they do not anastomose much, nor are their ramifications very numerous, and they retain, within the placenta, in a certain degree their spiral disposition. The veins are somewhat larger, straight in their direction, and with numerous anastomoses. Some have supposed that the connection between these veins and arteries was of the nature of a simple capillary circulation; but the researches of Reid, Weber, and Goodsir, have shown that their connection is of a special character, and offers the strongest possible contrast to a capillary system. According to them, the blood is conducted by the curling arteries into large irregular cells, or *Sinuses*, the walls of which are thin, and composed of the lining membrane of the maternal vascular system only. These sinuses communicate freely with each other, and from them the blood is returned to the uterus through the veins which are seen to pass through the utero-placental tissue. In fact, a considerable portion of the bulk of the placenta, when the organ is replete with blood, is said to be composed of a great venous cavity, which dips so deeply into the chorion as to attain its fœtal surface, but which is more distinctly seen in the tissue of the decidua. A large coronary vein has been described by Jacquemier and Meckel, as existing near the margin. It is, they say, rarely complete, but presents in its course frequent interruptions, where the continuity is maintained by subdivision and anastomosis; but, as their observations on the subject have not been confirmed by recent research, we may assume that the existence of such an arrangement is doubtful, certainly not constant. It is proper to add that the presence of a great venous cavity within the placenta has recently been seriously called in question.

Fig. 73.

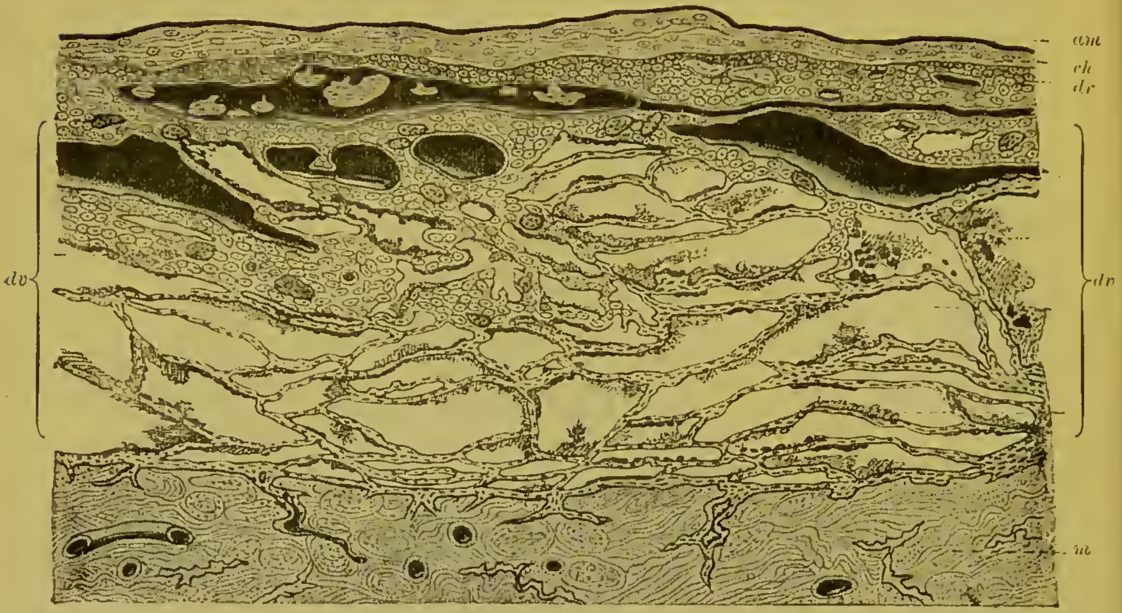


Section of the Placenta.

Fig. 74 shows the nature of the union between the membranes of the ovum and the uterus, close to the margin of the placenta, in the sixth month of pregnancy. The muscular tissue of the uterus is shown at *m*, with large blood vessels running through it. *am*, amnion; *ch*, chorion; *dr*, decidua reflexa. The larger portion in the centre (*dv*) represents the decidua vera, the structure of which in the upper portion is compact, while the spongy layer below is occupied by large cells or irregular interstices.

On the fœtal side, the vessels, on reaching the placenta, divide at once into large branches which are distinctly seen through the amnion. If this membrane be detached, which may easily be effected, as shown in the upper part of Fig. 71, both arteries and veins are observed to divide on the surface of the chorion. They then subdivide again and again, always dichotomously, and plunge into the thickness of the lobes. Here the arteries communicate freely with each other, so that if we inject one umbilical artery, the injection will return by the other. If, however, we tie the other, a successful injection will return into the umbilical vein, while the colour of the injection will be observed on the uterine surface of the placenta.

Fig. 74.

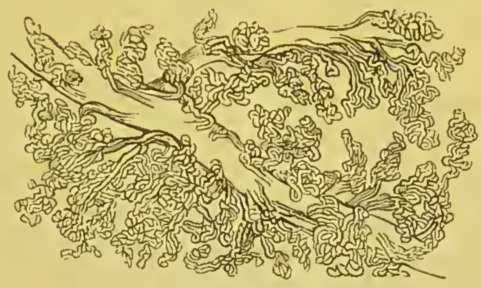


Section through the Membranes and the Uterus near the margin of the Placenta. (After Leopold.)

Placental Villi.—If we trace the arteries to their ultimate ramifications, we find that they are divided into innumerable tufts, fringes, or villi, which form in fact the bulk of the fœtal placenta. Each tuft is occupied by one or more capillary loops, and the current, after passing through these loops, returns by the effluent canals, which form by their union the umbilical vein. The vessels of this capillary system differ from other capillaries in their greater size, their caliber being such as to admit of several blood corpuscles passing abreast of each other. Throughout the whole placenta, the villi are found to project in the form of fringes into the placental sinuses, or, in other words, into the large venous cavity which is formed in the placenta by the union of these sinuses. Each fringe is thus bathed in maternal blood, and the fœtal blood passing through each loop parts with its carbonic acid and receives oxygen in exchange, precisely as occurs in the branchiæ of aquatic animals. And, further, as was first shown by Reid, a certain number of the fœtal villi pass *through* the placenta, and dip directly into the larger sinuses of the uterus itself.

Reid believed further, and his view is very generally accepted, that each tuft, in projecting into the placental cavity, pushes before it the lining membrane of this cavity, so that each fœtal villus has a special maternal investment. It is to be observed, however, that among English physiologists, Dr. A. Farre combats this view, and that both Coste and Robin are opposed to it. They believe that the walls of the uterine vessels are eroded and perforated by the villi, so that the walls of the latter are in direct contact with the blood of the mother. It may be noted, however, that either view of the case is sufficient to confirm the views first enunciated by the Hunters, that there is no commingling of the two systems. The accompanying illustrations refer to the arrangement and structure of the fœtal villi. In Fig. 76 the cellular covering which invests the villus is shown, except at its distal portion, where it has been removed to show the looped vessels.

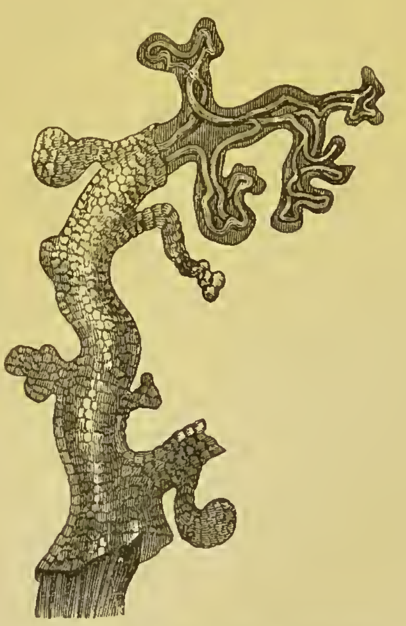
Fig. 75



Fœtal villi of the Placenta. (After Weber.)

It must be remembered that the oxygenation of the fœtal blood is not the only function of the placenta; but that through this channel also, material is supplied for the building up of the fœtal tissues, and effete matter is removed. The observations of Goodsir on this point, which are of the greatest possible interest, are corroborative of the views of Reid. These will be noticed when we come to speak of the nutrition of the fœtus.

Fig. 76



Ultimate fœtal villus, highly magnified. (After Ecker.)

The formation of the placenta commences in the latter part of the second month, and within a few weeks it acquires its essential characteristics. Small blood-vessels, for the special nourishment of the organ, pass from the uterus; but neither nerves nor lymphatics have been, as yet, satisfactorily traced. The Hunterian view which has here been given of the structure of the placenta is that almost universally entertained, and has received important corroboration from the researches of Turner,[1] but it is proper to add that some physiologists have denied the existence of a sinus system. The names of Velpeau, Radford, Ramsbotham, and Madge may be mentioned as holding more or less confidently the latter view; but of late the contribution in refutation of the Hunterian theory which has attracted most attention is the Essay which Dr. Braxton Hicks presented to the Obstetrical Society in 1873.

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[1] Journal of Anatomy and Physiology, 1875.

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CHAPTER VII.

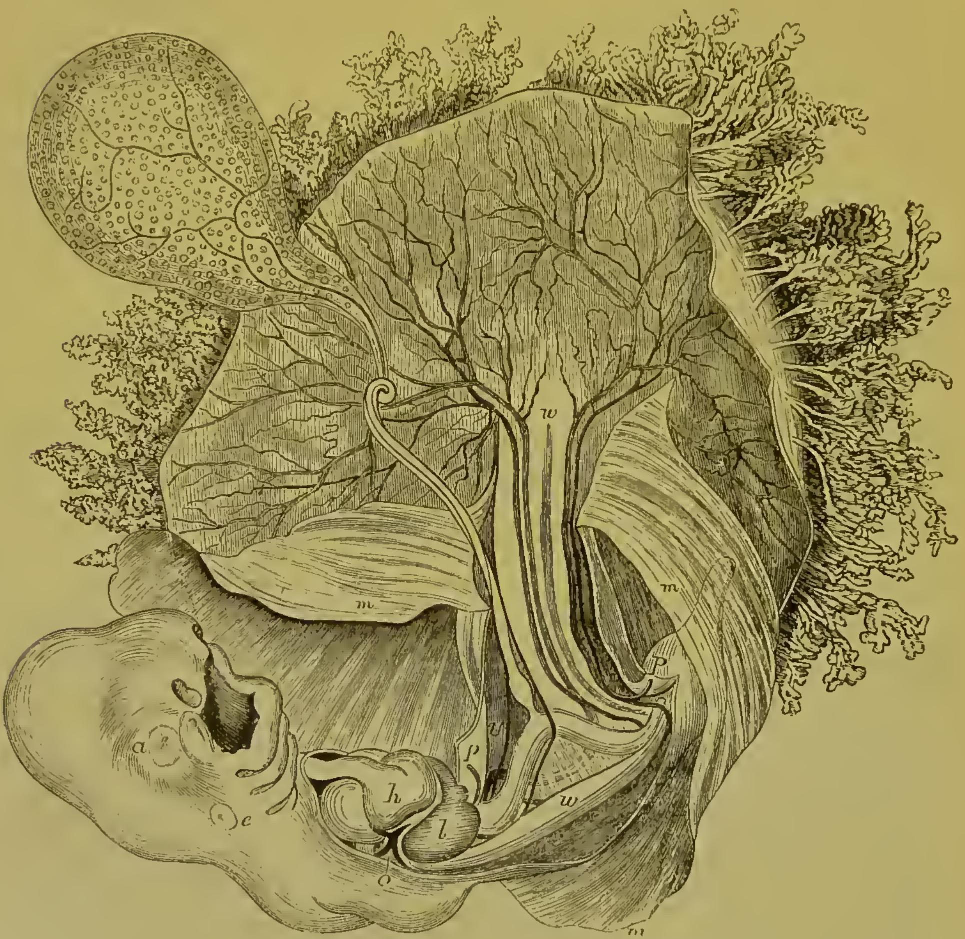
DEVELOPMENT OF THE EMBRYO AND FŒTUS.

Demonstration of Embryonic Structures.—Characteristics and Development of the Fœtus at the termination of each Month of Pregnancy, from the Third onwards.—Dimensions of Mature Children.—Attitude and Presentation of the Child in the Womb.—Causes of Cranial Presentation: theories of "Physical Gravitation," "Volition," and "Reflex Action."—The Fœtal Cranium: Sutures: Fontanelles: Diameters.—Definition of the term "Vertex."—Functions of the Fœtus: Circulation: Respiration: Nutrition: Secretion.

The term Fœtus is, according to usage, not applicable to the product of conception, until the termination of the third month of gestation. Till then it is termed the Embryo. A study of the formation of the various embryonic structures is a subject which, in so far as human development is concerned, is beset with many difficulties. Viewed, however, in the light which comparative physiology has thrown upon it, our knowledge of the various organs of which the individual is composed, and of their growth from primal elements, may be considered as tolerably complete. The opportunities which arise of examining the bodies of women who die in the earliest stages of pregnancy are so few, that a very peculiar interest attaches to such reliable descriptions and illustrations as have hitherto been given. Among all these, none perhaps have received more unqualified commendation than the well-known drawings of Coste, from which the representations which follow have chiefly been taken. To attempt a demonstration, or even a narrative of the development of individual organs, is only suitable to a systematic treatise on Embryology. A very superficial description will serve our purpose here, and may suffice to show, more clearly than is possible by any means other than actual dissection, the relations which the various parts of the ovum bear to each other, and to the maternal structures with which they are in contact.

The accompanying representation of the product of an abortion about the twenty-fifth to the twenty-eighth day, shows the embryo and its membranes partly dissected, and magnified about seven times and a half. The Chorion, which has been opened in its whole extent, is recognised by its villi externally, and by the numerous blood-vessels on its internal surface. Above, and to the left, is seen the umbilical vesicle, with the branches of the omphalo-mesenteric vessels coursing upon it. It lies, as has already been shown, between the chorion and the amnion, and its long narrow pedicle bearing the vessels is seen to pass into the umbilical cord, and finally, to terminate at the summit of the single curve which marks the commencement of the intestinal convolutions. The right omphalo-mesenteric artery is close below the intestinal canal, and included in the rudimentary mesentery. The left omphalo-mesenteric vein (*v*) is passing towards where the

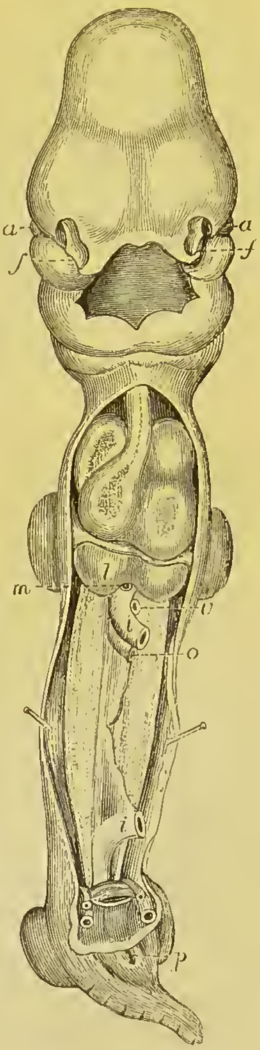
Fig. 77.



Ovum opened, and Embryo partly dissected.

stomach is beginning to develop, to discharge itself into the common trunk of the umbilical veins. This is the commencing vena portæ. The amnion (*m m*) has been freely opened to allow the embryo to escape, the caudal extremity being still within its cavity. The manner in which it is reflected to form the sheath of the umbilical cord is very clearly shown. The umbilical cord is opened in its whole extent to show its contents, including the canal of the urachus (pedicle of the allantois), which extends from the caudal extremity of the alimentary canal, closely accompanied by the umbilical vessels, and terminates at *w* in a cul-de-sac. On either side are the umbilical arteries and veins, the arteries springing from the lower part of the aorta, and the veins passing upwards, to unite before entering the liver and mix their contents with the general circulation, at the point of confluence (*o*) beneath the heart. The vein of the left side, which may be observed passing through the centre of the mesentery, is the permanent one, and is already much larger than its fellow of the right side, which has been cut across at *p p*. The heart (*h*), with its four cavities and the aortic bulb, is separated from the liver by an imperfect diaphragm. The Wolffian body of the right side (*w*) is shown passing from the heart to the inferior extremity of the intestine. Along its outer margin runs its excretory duct, which opens, along with its fellow of the other side, into the cloaca behind the rectum. The greater relative size of the cephalic extremity of the embryo is a striking peculiarity which at once attracts attention. The rudimentary eye (*a*) is remarkable, chiefly in respect of its lateral position. In front of it is the right nasal fossa, and below it, at *e*, is the earliest trace of the internal ear. The large bucco-nasal cavity, with the three branchial arches beneath it, also attract special notice.

Fig. 78.



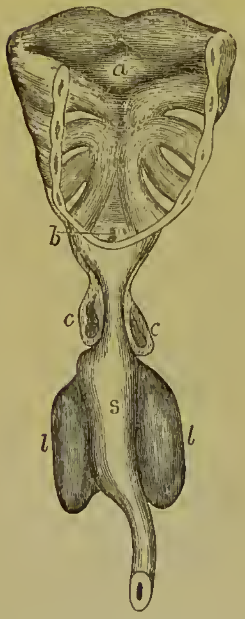
The same Embryo, further dissected.

Fig. 78 shows the same embryo magnified eleven times, carefully dissected, and seen from before. A portion of the intestinal convolution and of the mesentery has been removed, along with the anterior thoracic and abdominal walls, and the umbilical cord, so as to bring into view the most of the Wolffian bodies on each side, and the heart.

This representation shows more clearly the lateral position of the eyes (*a*), and the distance between the nasal fossæ (*f*), which are seen to communicate with the buccal cavity by a simple furrow. Between *a* and *f* are the rudiments of the superior maxillary bones. There is complete absence of all trace of palate. The position of the auricles, ventricles, and aorta, and the relation which these parts bear to each other at this age, are also more obvious from this point of view. Hidden to some extent by the heart, and separated from it by an incomplete diaphragm, is the liver (*l*), which is of equal size on the right and left side, and presents a fissure on its lower surface: it covers and conceals the stomach. The vessel which is seen in section within this fissure (*m*), is the common trunk of the umbilical veins. To the left, within the curve of the intestine (*i*), is the left omphalo-mesenteric vein (*v*), the one which, being permanent, ultimately becomes the vena portæ. Below the alimentary canal, and within the mesentery, is the right omphalo-mesenteric artery (*o*).

Extending downwards from the lower surface of the liver to the caudal extremity of the embryo, are seen on either side the Wolffian bodies, with their excretory ducts close to their external borders. The white band running along their inner margin is the rudiment of the internal generative organs. Between those parts is the divided mesentery, connected inferiorly with the alimentary canal (*i*). Immediately below this, the transverse slit shows a section of the cavity of the urachus, while the vessels, which along with it form the umbilical cord, are seen to surround it, the veins being below the arteries. It will be observed that one vein is already smaller than the other, and would ultimately have become obliterated. The buds or rudiments of the superior and inferior extremities are quite distinct; *p* is the common orifice of the genito-urinary system.

Fig. 79.

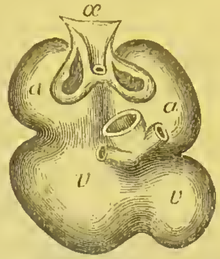


Posterior view of Branchial Apparatus, &c.

Fig. 79 shows the branchial apparatus, rudimentary lungs, stomach, and liver, from behind. Above, is the inferior maxilla, the two lateral halves of which have already united in the middle line. Between this and the superior branchial arch is the rudiment of the tongue. From above downwards are the first, second, and third branchial arches, separated from each other by slits or apertures (*branchiæ*). Into the pharyngeal cavity which is thus exposed, the branchial apertures, the œsophagus, and the glottis open.

The origin of the glottis is an oval eminence with a slit, which is indicated at *b*: *c c* are the rudimentary lungs pressed against the œsophagus, the right being lower than the left: (*s*) the stomach, at this period vertical in direction, and forming, with the œsophagus and alimentary canal, a nearly straight tube: (*l*) the liver, consisting of two nearly equal lobes, with a large furrow between them to accommodate the stomach.

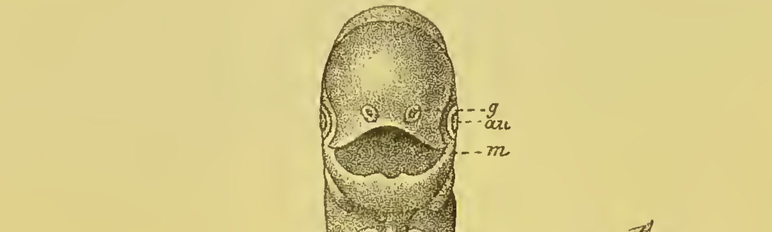
Fig. 30.



Posterior view of Fœtal Heart.

In Fig 80 the heart is seen from behind. The lungs have been preserved in order to show the relation, in size and position, which they bear to the heart. (*a a*) common auricular cavity, the right side being evidently more developed than the left; (*v v*) ventricular cavity, the left side larger than the right. The large vessel in the centre is the trunk common to the omphalo-mesenteric, umbilical, and azygos veins. That to the right in the figure is common to the superior azygos vein (superior cava of the adult), and the inferior of the right side; the smaller trunk to the left is

Fig. 81.



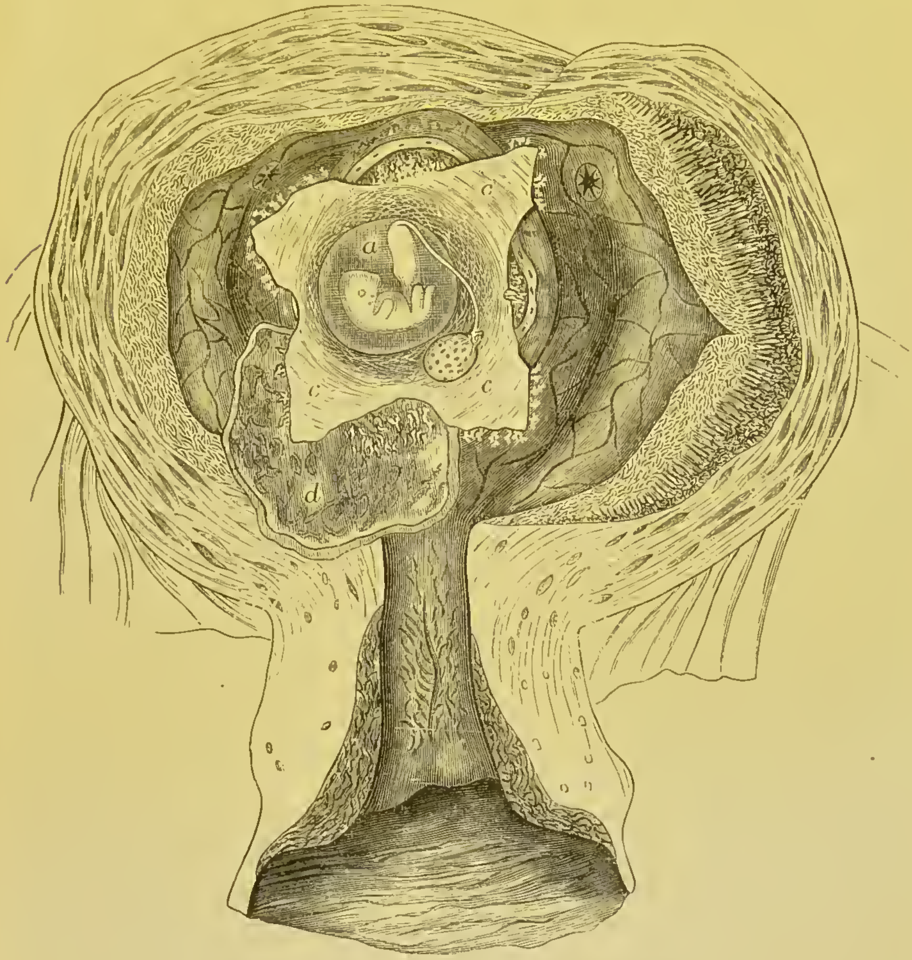
Embryo of a Dog of 25 days. (Bischoff.)

common to the azygos, superior and inferior, of the left side. (*œ*) Section of œsophagus.

Another view, illustrative of some of the points above noted, is afforded by the representation here given (Fig. 81) of the embryo of a dog, dissected, magnified five times, and seen from before. *d* is the alimentary canal; *ds* the umbilical vesicle; *al* the allantois; *un* elementary kidney; *l* the two lobes of the liver with the lumen of the omphalomesenteric vein between them; *ve*, *he* anterior and posterior extremities; *h* heart; *m* mouth; *au* eye; *g* nasal cavity.

The woman from whom the drawing (Fig. 82) was taken was, as may be inferred from the structure of the os and cervix, pluriparous. She committed suicide about the fortieth day of pregnancy, and her body was subsequently examined at the Morgue in Paris. The anterior wall of the uterus has been divided vertically in its whole length, and the uterus thus laid open. "The cavity of the uterus," says Coste, "was partly occupied by a sort of soft fluctuating tumour, caused by the presence of the ovum at this point. This tumour had externally all the appearance and the organization of the mucous membrane which lined the uterus in the rest of its extent, and was situated on its posterior surface in the space between the two Fallopian tubes. The tumour produced here by the presence of the ovum did not yet occupy the whole cavity of the uterus. About the lower third of this cavity was free, so that the interior of the uterus might be reached from the canal of the cervix without encountering any resistance. The internal orifices of the Fallopian tubes were, as well as that of the cervix, perfectly permeable, which was proved in the clearest manner by the observation of the orifice of the left tube, through which the ovum had passed on its way to the uterus." In order to demonstrate the structure and relation of the parts, a circular incision was first made through the decidua reflexa, and the flap thus formed was turned down towards the internal os. On its inner or everted surfuce (*d*), the lacunæ are seen, which have already been described as existing at this period of pregnancy for the reception of the villi of the chorion. The ovum itself was then opened by a crucial incision, and the flaps of the chorion (*c c*) turned aside, so as to show the amnion (*a*). Through the walls of the latter membrane, the embryo is seen floating freely in the liquor amnii. The short and thick umbilical cord is observed passing from its ventral surface to that part of the surface of the chorion where the placenta would afterwards have been found. The situation of the umbilical vesicle in the cavity between the chorion and the amnion (a point which the student has occasionally some difficulty in understanding) is here very satisfactorily shown, and also the long pedicle which penetrates the umbilical cord, and through which communication with the intestinal cavity of the embryo is still for a time kept up. The amnion is not yet of sufficient size to fill the cavity of the chorion, which still contains a portion of the vitriform substance (*magma réticulé* of Velpeau).

Fig. 82.



Dissection of an Ovum *in situ*, about the fortieth day.

This substance gradually disappears as the ovum increases in size, becomes compressed, and reduced to a layer of extreme thinness by the union of the amnion with the chorion, when all but a trace of the umbilical vesicle disappears.

After the development of the placenta is completed, and the villi of the free surface of the chorion have been absorbed, not only does the cavity between the chorion and the amnion disappear, but that which exists between the decidua vera and the decidua reflexa is also gradually encroached upon by the growth of the embryo. When these membranes finally adhere, that cavity is also obliterated; and now, for the first time, the product of conception may be said to occupy the whole cavity of the uterus, the cavity of the cervix being, as a rule, loosely filled by a mucous plug.

Third Month.—These changes are completed in the course of the third month, when the fœtus measures, in length, from five to six inches, and weighs about four ounces. The development of its limbs and other parts has advanced to such an extent, that the external parts may be said to be completely formed. The head, although still, relatively, of great size, is so in a much less degree than at an earlier period. The various cavities are completely closed. The formation of the palate, and the completion of the superior maxillary bones, has divided the bucco-nasal cavity. The branchial arches have disappeared as early as the fifth week, with the exception of one fissure which has developed into the external ear. The umbilical cord is already longer than the embryo, has assumed its characteristic spiral form, and is attached considerably below the middle point of the vertical measurement of the child. Previous to this, a loop of intestine occupied a portion of the cord, but this is now included, by contraction of the umbilicus, within the abdominal cavity. When that condition is permanent, umbilical hernia is the result. The globe of the eye is seen through the eyelids, and the pupillary membrane may be seen filling up the aperture of the iris. The nails have commenced to form, but are very thin, and almost membranous. The sexes are distinct.

Fourth Month.—At the end of the fourth month[1] the length of the fœtus will be found to have increased to 7 inches on an average, and its weight to nearly 9 ounces. On examining the head, the fontanelles are found to be of great size, and the sutures apart. Hair makes its appearance on the scalp, in the form of a slight down, which may also be noticed, in a still more delicate form, on the general surface. Fat begins to be deposited in the subcutaneous tissue. The muscular movements are brisk, although they may not yet have been recognised by the mother; and, in abortions which take place at this epoch, the movements are not only vigorous at the moment of birth, but may continue for several hours afterwards.

Fifth Month.—With the completion of the fifth month, the length of the body will usually be found to have increased to from 8 to 10 inches, and its weight to from 10 to 12 ounces, or even more.

Sixth Month.—At six months, it is from 11 to 12½ inches, and weighs something more than a pound avoirdupois. The growth of the hair has considerably advanced, and, in addition to that the scalp, the eyebrows and eyelashes are also beginning to form. On the surface of the body, the cutaneous structure now becomes more distinct, and the cutis vera and epidermis may usually, on careful dissection, be separated. The invariable wrinkling of the surface is the result of the minute quantity of sub-cutaneous cellular tissue which is developed up to this time, in proportion to the other structures. In the male, the scrotum is very small and empty. The nails are already solid.

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[1] The expression, "at the ——— month," is very loosely employed by many writers. When weeks are not mentioned, it is used in this work as meaning the completion of the ——— calendar month of the pregnancy.

Seventh Month.—In the course of the seventh month, the fœtus is from 12½ to 14 inches in length. The bulk, from this period, steadily increases, by the deposition of subcutaneous cellular tissue and the development of various organs; but, as the extent of this varies very greatly in different cases, it is difficult to say what should be stated as the average weight at this period. The bones of the cranium,—in which the process of ossification has already considerably advanced,—become more prominent, and the intervals between them less. It is usually said that about this time the pupillary membrane disappears; but this is a question in regard to which very considerable discrepancy of opinion has arisen. Velpeau denied the existence of the membrane in the human species at any period, but the opinion usually entertained in regard to this point, is that which we have mentioned,—that it exists during pregnancy, up to the termination of the seventh month, and then disappears. More modern observations have, however, shown that it is incorrect to suppose that this membrane is lost at the time mentioned, but that it loses its vascularity in a great measure, and is so transparent that great difficulty is experienced in its demonstration. "In every instance," says Mr. Jacob,[1] "where I have made the examination, I have found the *membrana pupillaris* existing, in a greater or less degree of perfection, in the new born infant,—frequently perfect, without the smallest breach, sometimes presenting ragged apertures in several places, and, in other instances, nothing existing but a remnant hanging across the pupil like a cobweb. I have even succeeded in injecting a single vessel in the *membrana pupillaris* of the ninth month." The eyelids now commence to open, and the testicles to descend in the scrotum.

Eighth Month.—By the end of the eighth month, the increase in the bulk of the child and its general plumpness become very obvious, and this is shown still more clearly by taking its weight and measurement as before, when it will be found that whereas the longitudinal measurement has not increased beyond 17 inches, and is probably less, its weight will have reached 4 to 5½ pounds. The skin is now red in colour, is no longer wrinkled, and is covered with down. Upon its surface is observed, in greater or less quantity, little masses of curdy or sebaceous matter,—a substance which is not of new formation, although it has become much more abundant. It may be noticed indeed as early as the fifth month. The scrotum now contains one testicle, usually that of the left side.

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[1] Cyclopædia of Anatomy and Physiology. Art. "Eye."

Fœtus at Term.—On the birth of the child at the termination of pregnancy, it will be found to measure from 19 to 24 inches, and to weigh about 100 to 130 ounces (say, on an average, about 7¼ pounds avoirdupois). The umbilicus was at one time believed to mark, at the full term, the middle point of the body, but the careful observations of Moreau and Ollivier d'Angers show that this is not the case, but that the middle point is generally about three fourths of an inch above the umbilicus. With the complete development of the child, there is, of course, increased thickness of the nails, and a considerable addition to the adipose tissue, which sometimes, indeed, is so considerable in quantity, as to raise the weight of the infant considerably above what has been set down as the average, and that without any corresponding increase in its length.

Many fables have been narrated as to children which have been born weighing 20 to 30 pounds, and being 3½ to 4 feet long. Twelve pounds is looked upon as a very great and unusual weight for a child at birth, but there are in this country few practitioners of experience who have not seen one or more such cases. In 4,000 cases in the Maternité. Madame Lachapelle only found one child which weighed 13¼ pounds. Dr. Rigby says that Sir Richard Croft delivered a living child 15 pounds in weight. Mr. Owens delivered a woman of a still-born child[1] which weighed 17 pounds 12 ounces. Another case of a still-born child which was said to weigh 19½ pounds is given by Cazeaux, but the weight was not taken by himself, and he seems to admit a doubt of it. A more recent case was reported by Mr. Passmore, of Crewe, in 1884, in which a male child was born alive weighing 20 pounds 2 ounces; its length was 23 inches, and circumference at level of nipples 14½ inches. Putting aside increased dimensions from disease, the above may be received as the extremes of authentic cases. It must be remembered, however, on the other hand, that many children, even at the full term, weigh much less than the average; but it is a recognised fact that, if the child be mature, it rarely survives if it weighs less than 5 pounds at birth, although its chance is considerably greater if a child of that weight be born prematurely. Female children weigh and measure less than males, and on this point it is said by Burns that 12 males are as heavy as 13 females. An interesting observation has been made by Dr. Guy, that "the mean weight of the bodies of still-born children, exceeds the weight of such as have lived one day, by from about $\frac{1}{6}$ to somewhat less than $\frac{1}{5}$." In the last months, the size of the placenta becomes greatly reduced in proportion to the development of the child; thus, at the sixth month, it is nearly half the weight of the child, while at the full term it is but a sixth or a seventh.

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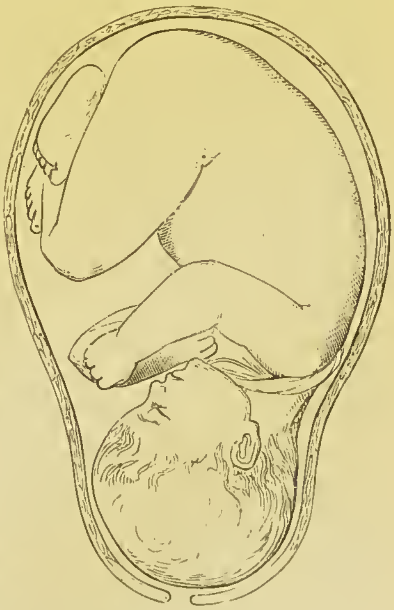
[1] Lancet, 1835.

Attitude, Presentation, and Position.—There are few matters of higher importance, with reference to the relation which the fœtus bears to enveloping and contiguous structures, than precision of nomenclature. At the same time, all who have had experience of the matter will confess that such precision, in regard to words which, in their vulgar acceptation, have a more extended signification, is a matter of no little difficulty. To obviate, as far as possible, any confusion which may arise, we shall here attach to the three words, "attitude," "presentation," and "position," a definite meaning to which we shall adhere in the sequel as closely as possible; and it may further be remarked that a clear understanding on this subject has saved German authors from many of the errors and perplexities into which English writers have fallen. By the *attitude* or *posture* of the fœtus in utero (Haltung) is meant the relation which its head, trunk, and limbs bear to each other; by *presentation* (Lage) is implied the relation of the long axis of the child to that of the uterus; while the word *position*, in its strict and limited obstetrical sense (Stellung), indicates the relation which definite parts of the fœtus bear to the anterior, posterior, or lateral regions of the abdominal or pelvic cavities. The varieties of a given presentation, according to the relation which the lowest or presenting part of the child bears to the pelvic canal, constitute the most familiar use of the last-named term.

Fig. 83.



Attitude of the Fœtus in Utero.

Attitude of the Child.—The shape of the womb being during the whole course of pregnancy more or less oval, the fœtus is found to have its various parts so composed as to adapt itself to the cavity within which it lies. In the early months of pregnancy, while the embryo still floats freely in the liquor amnii, and the envelopes of the ovum have not as yet come into contact with the uterine walls, the coincidence of the embryonic with the uterine ovoid is not an essential condition; but, even thus early, the ovoid form is being assumed, as is shown by the bending forwards, which approximates the cephalic to the caudal extremity. In this attitude, the development of the trunk and extremities proceeds, and, even at a period when there is still room for the fœtus to stretch itself, and extend its limbs, we find it constantly with back and neck bent, and limbs drawn up and flexed. This attitude of the fœtus becomes more marked as pregnancy advances; and, ultimately, at the full term, it is very constantly to be observed, as is shown in the accompanying diagram, with the vertebral column bent forwards, the chin inclined upon the sternum, the thighs strongly bent upwards on the belly, the knees bent, and the dorsum of the foot inclined towards the shin bone. The arms, more or less apart, are bent at the elbows, and the forearms are crossed or folded on the breast. In such a posture the child best adapts itself to the shape of the cavity in which it is enclosed, and which it pretty nearly fills.

Causes of Cephalic Presentation.—In no fewer than 96 per cent. of the cases of children born at the full term, the head of the child is turned—as in the figure—downwards towards the cervix of the uterus. The investigation of the causes which give rise to this law in gestation has long attracted the attention of obstetric writers. But, much as has been written on the subject, and ingenious as are many of the theories which have been advanced, it must be confessed that the problem has not yet been clearly solved. Few have prominently noticed the fact above mentioned, that the ovoid form of the fœtus is assumed while it is yet the embryo, and before it has been subjected to any influence arising from contact with the uterine walls. Manifestly, however, there is a cause,—subsidiary it may be,—which acts thus early on the embryo, to insure its safety at a later stage.

The earlier theories which were propounded are more curious than instructive. It was, for example, commonly assumed by the older writers that, in the early months, the head was normally uppermost, and that the sickness of early pregnancy was caused by an irritation of the diaphragm, produced by the hair on the scalp. It was, further, believed that about the seventh month the presentation became inverted, and that now, for the first time, the head was normally beneath.

Of all the theories which have been advanced to account for the presentation of the head, none attracted so much attention, or gained so much credence, as that which led to the opinion that it was due simply to physical gravitation. The fœtus, it was said, being suspended by its centre, in the liquor amnii, by means of the umbilical cord, its heavier or cephalic extremity must, of necessity, gravitate downwards; and this view was strengthened by the fact that the point of suspension was not the centre, but actually nearer the caudal extremity. It was obvious to those who refused to accept this theory that, however it might be held as applicable to the first weeks of pregnancy, such a mechanism could have no share in producing or maintaining the presentation after the cord had attained a length equal to the diameter of the ovum; and, further, that if the theory were correct, gravitation would be more likely to induce cephalic presentation in the early weeks of labour than at any other time. Every one knows, they argued, that, on the contrary, it is not at the beginning, but at the end, of pregnancy, that this is most constantly observed, and, therefore, the idea in question is wrong. Dubois, who took a prominent position in opposing the gravitation theory, further disproved it by some interesting experiments, which he made by plunging the fœtus in water and suspending it by the umbilical cord, when he found that it was not the head, but the scapula or back, which hung downwards, and first touched the bottom of the vessel. And to these arguments it might be added, that the placenta is not always attached to the fundus—which situation could alone admit of such gravitation; and again, that, in the lower animals the gravitation theory would place the head at the fundus, whereas, here also, we find the head turned to the os. In women, moreover, who maintain the horizontal position during the whole course of pregnancy, the cranial presentation is as constant as in other cases.

An ingenious plea in favour of gravitation, as a cause of the ordinary presentation, has more recently been advanced by Dr. Matthews Duncan, who energetically controverts the opinions of Dubois, Simpson, and Scanzoni, and who insists, with much propriety, that, in deciding this point, we should always remember that, while the mother is in the erect posture, or when she is lying on her back, the uterus is far from vertical; that, on the contrary, it is only when the trunk is inclined backwards at an angle of 30° to the horizon that the uterus can be said to be vertical, and that the mature fœtus is only horizontal when the woman lies upon her side. Dr. Duncan's arguments are of too controversial a character to be usefully epitomized; but they must be referred to with the respect which they merit, and which they will always command.

The name of Dubois is, in this particular matter, associated with a theory, the evidence in favour of which is, we must admit, singularly inconclusive. M. Dubois supposed that, in obedience to some instinctive impulse or act of volition, certain movements were, towards the end of pregnancy, executed by the fœtus, with the object of bringing the head into the lower segment of the uterus. This renowned obstetrician derives his chief argument from the harmony which he believed to exist between the object which nature had in view, and the means which she adopts, with a view to secure it. It is more than likely that Dr. Tyler Smith is correct when he surmises that, "had he (Dubois) written after the reception of Dr. Marshall Hall's great discovery of the spinal or physical movements, as distinct from the cerebral or psychical motor actions of the animal economy, he would probably have referred the motor powers of the fœtus to reflex action, instead of to instinct or volition."

The late Sir James Y. Simpson, in a series of admirable papers on this subject, argued that the presentation of the fœtus is due, in the first instance, to a succession of reflex or "adaptive" movements, and that, when it has once assumed the usual presentation, it is maintained in it, when displacement is threatened, by a repetition of similar reflex acts, which rarely fail to insure its reposition. It is in this way, and on this principle, that violent fœtal movements succeed such changes in the maternal posture as may lead to the displacement of the fœtus; and he adds, further, that in cases of long cord, and in those in which the quantity of liquor amnii is much above the average, such movements on the part of the fœtus are more frequent, and are of greater violence than usual. These last statements are certainly open to doubt.

Cazeaux attaches great weight to the form of the uterus, as *mechanically* inducing the presentation of the fœtus in the last months of pregnancy, the broader or breech end of the fœtal ovoid being necessarily turned towards the fundus, and the smaller, or cephalic end, consequently directed to the os. Some consider the child as composed of two ovals, one formed by the head, and the other by the trunk and limbs, and that, corresponding to these, the outline of the uterus is observed to consist of a portion of two ovals, as may be seen by looking again at Fig. 83.

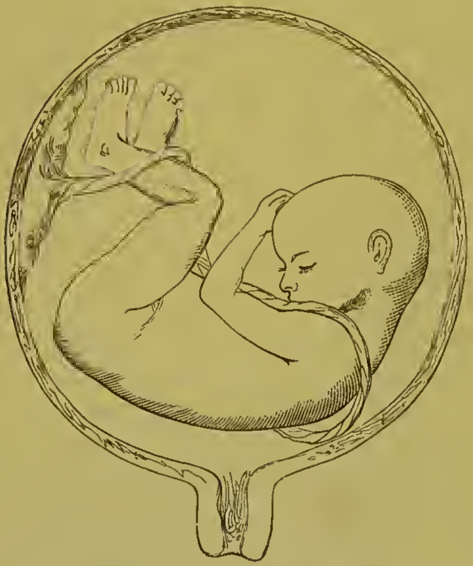
It must be remembered, however, with reference to these various theories, that it is only in cases at the full term that the head presents in 96 per cent.; and, with regard to most of the observations which have been made, that they have reference mainly to cases occurring at this period. It is universally admitted, that the earlier the period of the pregnancy, the less constant is the presentation of the child. The following table, founded upon the observations collected by Professor Dubois, at the Maternity Hospital of Paris, has been constructed by Simpson, and is, as he says, sufficient to prove "that the position (presentation ?) of the fœtus, with the head lowest, and over the os uteri, does not begin to be assumed till about the end of the sixth month, and that it is taken up with increasing frequency and certainty from that period onwards, to the full term of pregnancy." It must be noticed, however, with reference to this table, that, whereas the returns for the first, second, and fourth lines, have reference to children born during the specified period, whether alive or dead, the figures in the third line, of children born during the eighth and ninth month, refer only to children born dead.

Period of Pregnancy.	Total Cases.	Presentations of			Percentage of Head Presentations.
		Shoulder.	Breech.	Head.	
Before end of 6th Month,	121	5	52	65	52 in 100
During 7th Month, -	119	6	31	82	68 in 100
During 8th and 9th Month,	96	2	22	72	76 in 100
At full term of Gestation.	100	1	3	96	96 in 100

The reason of the greater variety of presentation in the early months is sufficiently obvious. Not only is the child at this period smaller relatively to the cavity which is prepared for it, but the form of the cavity itself is such, as comparatively to encourage changes of the presentation. Until the sixth month, the cavity of the cervix not having been as yet encroached upon in the process of development, the child is contained in the body of the uterus. Most anatomists agree that, up to this period, this cavity is round, and not oval, so that, as in the annexed diagram (Fig. 84) a fœtus of five months may move much more freely in any direction than is possible at the full time, when it is closely embraced by the pyriform or ovoid womb.

It must be confessed, however, that the causes which lead to the presentation of the head constitute a subject still shrouded in no little obscurity. The fact being clearly established, we see no need to pin our faith exclusively upon a single theory, particularly as it is more than probable that most, if not all, of them point to individual causes which, acting successively, or in concert, produce the effect which we have been considering. No theory quite satisfactorily accounts for the fact that the embryo assumes its ovoid form at so early a date of development. We know, of course, what Harvey first taught, that "all animals, while they are at rest or asleep, fold up their limbs in such a way as to form an oval or globular figure." This has been ascribed by modern physiologists to the greater muscular tone and contraction of the flexor as compared with the extensor muscles; but, dating from a period of development antecedent to the formation of muscles properly so called, it is questionable whether even this will throw much light upon the point in question. In regard to the theory of gravitation, as originally promulgated, it is now sufficiently obvious that suspension by the cord cannot be the cause of the usual presentation at the end of pregnancy. It would be too much, however, to assume that gravity exercises no influence upon the fœtus; indeed, the experiments of Matthews Duncan and Cazeaux point to a directly opposite conclusion. On the whole, however, we incline to the idea of reflex action, as affording the most reasonable theory which has yet been promulgated; but, far from shutting out the hypothesis of gravitation, we can conceive nothing more likely than that the vital force and the physical law act harmoniously together here, as elsewhere, at the bidding of nature.

Fig. 84.



Uterine Cavity at the Fifth Month.

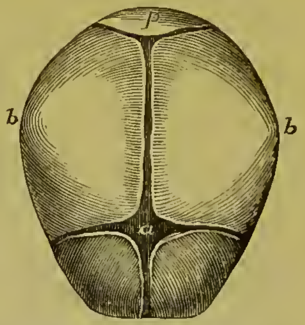
When the fœtus is abnormally situated in the womb, the walls of this organ yield, and adapt themselves to the altered circumstances of the case. The bent posture is, however, always maintained, and the fœtal ovoid is only distorted, in a marked degree, when the violent pressure of the contracting walls acts upon a misplaced fœtus. It is in the ordinary presentation that the ovoid is most regular and marked,—the larger pole being upwards, and occupying the expanded fundus, while the smaller is turned towards the vagina. If we take the longest, or bi-polar measurement of the ovoid, at twelve inches, the broadest part of the larger end, from the lumbar region to the sole or edge of the foot, will usually be found to be about eight inches, and to correspond to the greatest transverse measurement of the cavity. Obviously, therefore, any marked alteration in the attitude or presentation of the child implies corresponding distortion of the outline of the womb. The fact of the smaller or cephalic end being only some four and a half inches in its larger or occipito-frontal measurement, has led to the idea which has been frequently expressed, with reference to the mechanism of delivery, that the child thus placed was a wedge, and that the smaller end dilated the parts for the passage of the larger breech. Nothing can, in point of fact, be more erroneous than this, or more likely to lead to serious practical blunders. For we find that, when the pelvic end presents at the os, labour, far from being retarded, often advances, up to a certain stage, with unusual ease and rapidity,—a fact which is owing to the plastic nature of the structures of which it is composed. If the cephalic end were really a wedge, the head, or apex of the wedge, would never fail, in those cases, to follow the breech at once, and with ease. But as it does not, and is often extracted only after much suffering, and at great risk to the child, we cannot admit the simile to be a happy one. The fact is, that the smaller end of the ovoid is the really formidable structure in the act of parturition, from its comparatively unyielding nature, due to the special means which are adopted for the protection of the important nervous centre, upon the integrity of which the life of the infant depends. When the head has passed in safety, it is rare, indeed, that there is any difficulty in the birth of the other parts. To the obstetrician, therefore, one of the most important practical points in the study of his art is the thorough comprehension of the fœtal cranium, and more especially of its relation to the pelvis, and to the other maternal structures which have already been described.

The Fœtal Cranium.—The bones which compose the cranium and face are found, at the period of delivery, to have reached different stages of development. With a view, no doubt, to the perfect protection of the delicate structures at the base of the brain, the bones which form the base of the cranium, and the greater part of the face, are already so fused together as to admit of little or no movement. It is different, however, with the flat bones of the vault. The subjacent parts of the great nervous centre, being less essential to life, admit, with perfect impunity, of a certain amount of compression, which is facilitated by the imperfect ossification of the flat bones. The various parts of which the cranium is composed are, of course, familiar to every student of anatomy. It will suffice, therefore, to notice those points only which are of special obstetrical interest.

Sutures.—These are, first, the *sagittal*, which runs along the vertex from the anterior to the posterior fontanelle. In continuation of this, there runs forwards a suture, which is peculiar to early life, and which is described by some writers as a part of the sagittal suture. This, which divides the frontal bone into two equal parts, is usually named the *frontal* suture. The *coronal* suture marks the line of demarcation between the frontal and parietal bones; while the *lambdoidal* suture runs outwards and downwards, from the posterior fontanelle, separating, on either side, the posterior margin of the parietal from the occipital bone, and having thus the appearance of a bifurcation of the sagittal suture posteriorly, it presents some resemblance to the Greek letter from which it takes its name. At the base of each parietal is the suture which unites it to the corresponding temporal bone. The ossification of the bones, at all these points of contact, is so incomplete as to admit of very considerable motion; and in some situations, as at the sagittal suture, the bones overlap each other to such an extent that, by reducing certain diameters, a great mechanical advantage accrues in the act of parturition.

Fontanelles.—The angles of the bones are the points at which the development is least advanced, and it is here that certain gaps are left, where membrane only intervenes between the scalp and the brain, and through which the pulsations of the latter may be observed. These gaps are called the Fontanelles. The largest, the *great* or *anterior* fontanelle, or *bregma* (Fig. 85, *a*), is irregularly lozenge-shaped, of considerable size, and easily recognised by the finger during labour. The larger portion of it is in front of the coronal suture, whence it is sometimes continued forwards, almost to the root of the nose. The *posterior* fontanelle (*p*) is very much smaller, and is triangular in shape. As the occiput is almost always turned forwards, it is this fontanelle which the finger usually touches in an examination during labour; but in well-developed crania, and more especially when overlapping of the sutures has taken place, it scarcely merits the name of a fontanelle, but is rather a point at which the lambdoidal and sagittal sutures meet. In a digital examination, it is of importance that the accoucheur should be able at once to distinguish between these fontanelles, for it is mainly by marking their situation that he is enabled to recognise the exact position of the head. At first, the student will find some difficulty in ascertaining this, but a little care and attention will soon enable him to overcome the trifling difficulty; and he will find it useful, when in doubt, to run his finger round the gap, and count the sutures which run into it:—in the case of the anterior fontanelle, these are *four* in number, and, in that of the posterior, *three* only. The tumefaction of the scalp, which is so common an occurrence in difficult labour, may render such an examination difficult; but in the absence of this, the only circumstance which might mislead him, on a hurried examination, would be the presence

Fig. 85.

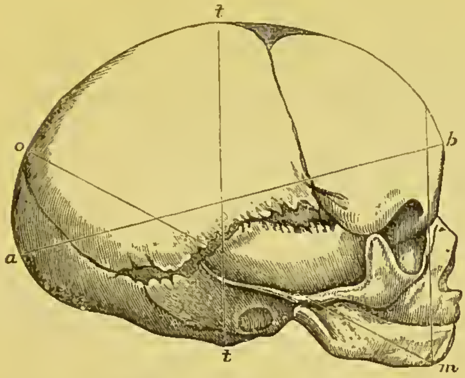


Upper Surface of Fœtal Cranium.

of the irregular bones, called *ossa triquetra.* Some writers describe lateral fontanelles at the inferior angles of the parietal bones, anteriorly and posteriorly; but these are so covered in by the temporal muscles, that it is only under very exceptional circumstances that their observation can be of any practical moment.

Measurements of Fœtal Cranium.—It must now be obvious that a correct knowledge of the size of the cranium, and the relation which it bears to the pelvis in its various diameters, must in no small measure be our guide to intelligent and skilful practice. Numerous measurements have been taken of the fœtal cranium, for the most part between points arbitrarily selected. It is, however, only the most important of these diameters with which the memory need be charged, viz., the *occipito-frontal* the *occipito-mental,* and the *bi-parietal;* and, in addition to these, we shall mention only the *trachelo-bregmatic* and the *fronto-mental.*

Fig. 86.



Diameters of the Fœtal Cranium.

The Occipito-frontal, or long diameter of the oval cranium, is an imaginary line, extending from the frontal eminences anteriorly to the occiput posteriorly. It is somewhat doubtful what some authors mean in this case by "the occiput," but there is no doubt that most modern writers, who are exact in the matter, describe it as terminating at the summit of the occiput, or, in other words, at the posterior fontanelle. If, during labour, the attitude of the head in relation to the trunk were the same as in an adult in the erect posture, this would doubtless be correct. But, if we recall the fact that the chin of the child is applied to the sternum, and that the occiput passes into the pelvis considerably in advance of the forehead, it seems more correct to adopt the view of Cazeaux and some others, and draw our line (Fig. 86, *a b*) to the occipital protuberance. The actual measurement, it is true, is only fractionally greater, but the line indicated is certainly more nearly in coincidence with the plane of the pelvic brim and the upper part of the cavity, than that which is usually described.

The Occipito-mental is the largest of the cranial diameters, and exceeds that just described, if we make an allowance for an average amount of moulding, by about an inch. It is thus of great importance with reference to the mechanism of parturition, and is represented in the figure by the line *o m*, drawn from the point of the chin to the posterior fontanelle. The Bi-parietal diameter (*b b*, Fig. 85) extends transversely from one parietal protuberance to the other. The Trachelo-bregmatic (Fig. 86, *t t*) is from the posterior extremity of the anterior fontanelle, to the anterior margin of the foramen magnum; and the Fronto-mental, *b m*, from the level of the frontal eminences to the point of the chin. Most of these diameters will be increased or diminished in direct proportion to the amount of pressure to which the head is subjected, and the consequent degree of moulding which it undergoes. It is, on that account, extremely difficult to state averages, and the recognised differences which subsist between male and female crania, not to speak of the varieties depending on race, still further increase the difficulty. Taking, however, the average of male and female crania in Europe, the following measurements probably come very near the truth,—if at the same time we make due allowance for average moulding, which, if we are to estimate the size of crania at the moment of birth, must certainly be done.

Average measurements of male and female Fœtal Crania :—

Occipito-frontal diameter,	4½	inches.
Occipito-mental ,,	5½	,,
Bi-parietal ,,	3½	,,
Trachelo-bregmatic ,,	3¾	,,
Fronto-mental ,,	3½	,,

It is scarcely necessary to add, that these measurements refer to cases in which the head is born in the occipito-anterior position. In other cases of abnormal or unusual position, the moulding will be modified to suit the requirements of the case, and the diameters will thereby be relatively altered. The same remark applies to circumferential measurements, which are usually stated, as regards the occipito-frontal circumference, as about fourteen inches, and for the occipito-mental as sixteen inches. According to Dr. Tyler Smith, "the ordinary presenting circumference, which passes under the occiput, and round the parietal bones to a little behind the bregma, is about eleven and a half inches."

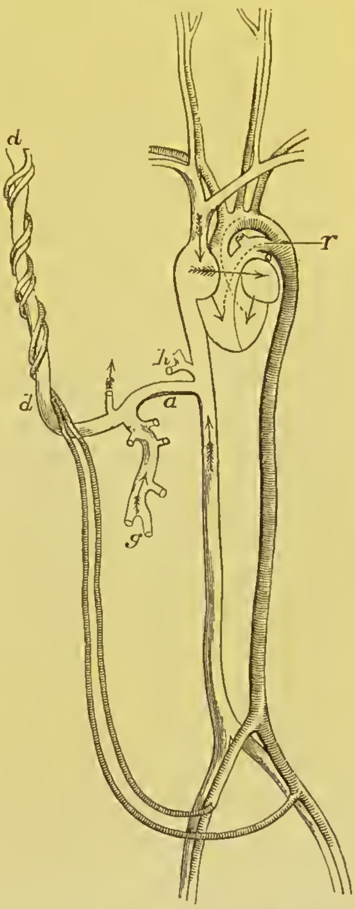
Vertex.—In descriptions of fœtal crania, and of cranial positions, the term "vertex" is constantly adopted by English and American writers. Unfortunately, however, this is one of several terms which are so loosely used, that it is necessary to give a definition before venturing to employ them. It is described in Todd's Cyclopædia as synonymous with the anterior fontanelle; by Dr. Ramsbotham, as a point a little in front of the posterior fontanelle; by Smellie, as the whole space between the two; and by Schmidt, as a point midway between the anterior and posterior fontanelle. Of all these, the most usual description is that which places the vertex in or close to the posterior fontanelle. The expression "crown" or "vertex" implies that portion of the head which is highest in the erect posture. If so, the vertex can neither be the anterior nor posterior fontanelle, but a point intermediate between the two, varying somewhat according to the peculiar formation of different crania, so that it is difficult to determine the exact *point.* If it were absolutely necessary to describe it as such, we should probably closely approach the truth by placing it with Schmidt at a point midway between the two fontanelles. But if we consider the infinite varieties which obtain in the relative situation of the two fontanelles, as regards the pelvic axes, so that any one point of the sagittal suture may in certain cases present, it then becomes obvious that to the term vertex we must attach a more extended signification, if we would avoid complicated systems of classification. On these grounds we prefer the definition of Smellie, and shall use the term vertex as including the sagittal suture in its whole length, and, on either side, that portion of the parietal bone (once called *os verticis*) which lies between the suture and the protuberance.

Functions of the Fœtus.—The Fœtus being, during the whole period of its intra-uterine life, separated from the outer world, and immersed in a liquid medium, those functions which, after birth, are discharged under the usual atmospheric conditions, and in consonance with the ordinary laws of nutrition, fall to be performed after a fashion adapted to the peculiar circumstances of the case. We find, therefore, that, in the absence of aerial respiration, certain special modifications of the circulatory apparatus have been adopted, with the view of affording that gas to the blood, and that nutritive material to the frame, without which life within the womb would be a physical impossibility. A knowledge of this subject is essential both to the physiologist and to the accoucheur; and it is only in the light of such knowledge that certain morbid phenomena and faults of development can be understood, and possibly, in some instances, obviated.

The life of the fœtus is maintained by an intimate union between the maternal and fœtal circulatory systems, a union in which, although there is no junction of the two currents, there is ample provision for the mutual interpenetration of gases and fluids, and also for the interchange of cell elements. We do not allude now to the laws which regulate the development of the early embryo, but to the union which subsists after the development of the organs of connection which have already been described, and which exist in almost all the Mammalia. The lungs of the fœtus are, up to the moment of birth, apparently rudimentary. We say "apparently," because, although in point of size and texture they present little resemblance to the organs of respiration, when that function has been once established, they are in the mature fœtus already perfect in structure, and only await inflation to become the important organs, the function of which only ceases with life. In the adult, and dating from birth, the circulation is usually described as consisting of two tracts, mutually dependent upon, and yet in a sense distinct from, each other, the systemic and pulmonary channels, through which the whole column of blood continuously and successively flows. In the fœtus, however, the function of the lungs being impossible, that portion of the circulatory current which is associated with the function of aerial respiration is diverted from its course by special conduits, which join the circuit at a more advanced point, the pulmonary system being thus practically *nil,* although its apparatus is fully prepared against the moment of birth. From the systemic vessels, again, blood passes to the placenta by the umbilical arteries, and returns by the umbilical vein to join the general venous system of the child. As the other functions of the fœtus depend chiefly upon the modifications of what we know as the adult apparatus, we may here describe these shortly.

The Fœtal Circulation.—The blood which returns from the placenta by the umbilical vein (Fig. 87, *d*) is charged with oxygen derived from the mother, so that the term "venous blood" is here in its ordinary sense, inapplicable. After passing through the umbilicus, the vessel divides. A portion of its contents enters the liver, along with the blood which is being returned from the intestines by the vena portæ (*g*), and, after circulating in that organ, enters the vena cava at *h.* The greater portion of it, however, passes direct to the vena cava, by the *ductus venosus* (*a*), which joins the main trunk at a point a little lower than the hepatic vein. The blood, being thus mixed with the systemic venous current, arrives at the heart much more feebly oxygenated than it was at the umbilicus, and passing into the right auricle, is directed by the Eustachian valve towards the *foramen ovale,* a special aperture through which the blood from the inferior cava is transmitted to the left auricle. From this point the current passes to the left ventricle, and from thence, as in the adult, to the aorta, almost the whole of this supply proceeding to the head and superior extremities by the three great vessels of the aortic arch, to return again to the right auricle by the superior cava. Although a mixture of the two currents from the venæ cavæ must, to some extent, inevitably occur, the blood of the superior vein passes, almost in its entirety, through the tricuspid valve into the right ventricle, and thence to the commencement of the pulmonary artery. The condition of the lungs not being such as to receive this large column of blood, another special structure, the *ductus arteriosus* (*r*) is interposed, through which the current is diverted, and conducted directly into the descending aorta. Along with a little blood from the left heart, this column passes downwards to the lower part of the body, most of it going to the placenta by the umbilical arteries, from whence, charged with oxygen, it again returns to the vena cava inferior. It will be observed that three special conduits thus exist; two of them, the foramen ovale and ductus arteriosus, being designed with the direct object of diverting the circulation from the lungs, while the other serves to connect the vena cava with the umbilical vein. In addition to these, which are completely obliterated after birth, there are the umbilical arteries, which are permanent in a portion of their course, forming the internal iliac and superior vesical arteries.

Fig. 87.



Circulatory apparatus in the Fœtus.

The Lungs enter upon their function immediately upon the birth of the child, and when anything occurs to prevent the speedy occurrence of the respiratory act, the child is still-born. The sudden inflation of the lungs which thus occurs, and the arrest of the placental circulation, consequent upon the separation of that organ from the mother, give rise to immediate changes in the direction of the current, which are the first steps in the obliteration of the special fœtal structures which have been described. The essential phenomenon is the transference of the seat of respiration from the placenta to the lungs. By the consequent development or unfolding of the pulmonary vessels, a vacuum is created, which draws the blood from the right ventricle directly, and for the first time, into the pulmonary circuit. The aorta, lacking thus the important source of supply which it had hitherto derived from the ductus arteriosus, sends a diminished supply of blood in a feeble stream to the umbilical arteries, thus encouraging the stasis of the blood in the fœtal portion of the placenta. This causes a marked diminution, and soon a complete cessation, of the flow of blood through the umbilical vessels. When the left auricle is sufficiently supplied, by the return of the blood from the lungs through the pulmonary veins, the foramen ovale is closed by the pressure of the blood upon its valve, the closure being further encouraged by the diminution in the supply of blood to the right auricle. which is the necessary result of the arrested circulation in the umbilical vein. These facts make it clear how important it is that the establishment of aerial respiration should be simultaneous with the arrest of the placental circulation. It is only upon the complete establishment of the pulmonary circulation, that the distinction between arterial and venous blood can, with perfect propriety, be drawn. There is no longer a mingling of the two currents, and they now assume within their proper vessels the physical characteristics which serve to distinguish them.

The time at which the obliteration of the fœtal apertures takes place, and the order in which they close, are facts of some medico-legal importance. Effective closure, if not obliteration, of all of them, will generally be found to have occurred by the ninth day, although they may remain patent for twelve or fifteen days, or even longer, without any inconvenience to the child. The umbilical arteries are usually impermeable from the second day, owing to contraction and thickening of their walls; the umbilical vein and ductus venosus always close after the arteries, generally about the sixth or seventh day. The ductus arteriosus and foramen ovale are the last to be obliterated, but rarely remain permeable longer than the period above stated. In the embryo, there is but one auricular cavity; but, about the third month, a semilunar valve, containing fleshy fibres, marks the first growth of the partition which ultimately separates the right from the left auricle. Permanence of the aperture may constitute the affection known as Cyanosis. Dr. Tyler Smith held that the closure of the fœtal apertures is, in a great measure, due to the mechanical effect of the inflation of the lungs; and there can be little doubt, we believe, that this contributes to the result, by the pressure which is exercised, in one direction, by the left bronchus, upon the ductus arteriosus, and, in the other, by the displacement downwards of the liver, upon the umbilical vein and ductus venosus. The changed position of the heart also tends to the closure of the foramen ovale. Another very marked result of the alteration in the circulatory system,—one which acts somewhat more slowly,—is the thickening of the walls and augmentation in the capacity of the left heart, which, prior to birth, is subordinate to the right heart in both of these particulars. In three or four weeks this change is very obvious.

The blood of the mature fœtus does not differ materially from that which occupies the vessels after birth; but, owing no doubt to the comparatively imperfect oxidation which takes place in the placenta, and the manner in which the two systems mingle, there is not observed that contrast in colour which enables us to distinguish arterial from venous blood. As regards the blood of early embryonic life, few opportunities occur in which it can be examined; but, from what has been observed, it would appear that it is of a dark colour, coagulates feebly, is deficient in fibrin, and becomes but little reddened on exposure to the atmosphere.

Respiration.—From what has just been said, in reference to the course of the circulation of the blood in the fœtus, it will be obvious that the respiratory function must be carried on in the placenta,—the most important of whose functions, indeed, is that of an intra-uterine lung. We need not pause here to discuss exploded theories as to the source from which oxyen is derived by the fœtus. The researches of Bischoff proved that, even in the embryo, respiration by means of the branchial fissures is impossible, and that, in point of fact, these structures have no connection whatever with this function, as was at one time erroneously supposed by Geoffroy Saint-Hilaire and others. Two facts stand out prominently:—first, that a constant supply of oxygen is necessary to the life of the fœtus; and, second, that that supply cannot be obtained directly from the air. Whence, then, is it derived?

The full description, which was given in a former chapter, of the structure of the placenta, may suffice for an answer to this question, in so far as regards that period of intra-uterine life during which the placenta exists. But, for the period of embryonic life, some further description is required; and, indeed, there is still, in regard to this point, some necessity for extended research. M. Serres has described two periods,—the first of these, which he terms the period of *branchial* respiration, exists down to the time when the placenta is formed. He assumes that, among the villi of the chorion, there are a certain number (*villosités branchiales*) which dip into the lacunæ of the decidua reflexa, and are there bathed in a special fluid, from which the supply of oxygen is derived until, in the course of development, the second, or placental period, arrives. To what extent, if at all, this theory may be admitted as correct, it is at present impossible to determine; nor would it serve any good purpose to enter here upon the discussion of this or any mere physiological speculation. We shall at once, therefore, assume, as facts hitherto observed entitle us, that, from the earliest period at which the necessity of a respiratory function may arise, the essential supply of oxygen is derived from the mother, and passes through the external surface of the ovum, the villi of the chorion, or the villi of the placenta, according to the stage of actual development. The function of respiration involves the interchange of gases; but whether this interchange takes place in consonance with the laws which regulate interpenetration of fluids, or by passing through some intermediate vehicle, as is presumed by Serres, the source of the supply may, in all cases, be assumed to be the same. In point of fact, the respiration of the fœtus bears the strictest analogy to the branchial respiration of fishes, in which a membranous structure only is interposed between the blood and the liquid from which the oxygen is to be derived. In the placenta, as we have seen, the parts are so disposed as to bring as large a portion as possible of the two systems, maternal and fœtal, into contact.

That, in consequence of this contact, the blood undergoes important and vital changes is proved by many facts, pathological and otherwise. To compress the cord, is to cause the certain death of the fœtus; but, more significant even than this is the fact that, after death from this cause, the physiological phenomena of apnœa are invariably developed. There exists, also, a marked respiratory antagonism between the placenta and the lungs. So long as the placental circulation is still uninterrupted, the new-born infant may live without pulmonary respiration; but, so soon as it breathes strongly, the blood no longer passes by the cord, or if it persists to a certain extent, it may at once be stopped by ligature. But, if the child has not breathed, it is always wrong to tie a pulsating cord until aerial respiration has been set up. Finally, the respiratory function of the placenta has been proved by analysis of the blood from the umbilical arteries and veins, the blood in the vein always showing a comparative abundance of oxygen, although, as already mentioned, the quantity of this gas is not sufficient to establish that marked difference in colour, which enables us so readily to distinguish between ordinary arterial and venous blood.

Nutrition.—This function is intimately associated with that of respiration. All modern physiologists admit that the nutritive supply comes from the mother, but the exact manner in which it is absorbed, and the proportion in which it passes through various channels and media, are points which have given rise to endless disputes and many hypotheses. It is certain that the nutritive material cannot, at all stages of embryonic and fœtal development, pass through the same course in its way from mother to child; and, in truth, our knowledge of the history of development prepares us for the admission that the plan of nutrition must differ materially according to the stage at which the fertilized ovum has arrived. Even at the very earliest stage, while it still moves freely in the Fallopian tube, absorption from maternal sources may take place by endosmosis through its external envelopes, which also admit of penetration by the fertilizing element contributed by the male. But, in addition to this, there is a store of material, which we have reason to believe is in some measure nutritive, contained in the umbilical vesicle.[1] The quantity of this fluid yolk, and the proportion which it bears to the size of the embryo, is at first very great, but as changes succeed each other within the ovum, in the manner already described under the head of Development, the relative quantity dwindles, and the reservoir itself becomes ultimately absorbed, after being drained of its contents. The connection of the umbilical vesicle with the rudimentary intestine, the chemical composition of its contents, and, more significant still, the establishment in its walls of blood-vessels proceeding from the fœtus, suffice to prove this position. After the development of the allantois, vessels are carried from the embryo to the chorion: the villi of the latter become enlarged and vascular, implant themselves in the decidua, and thus bring fœtal vessels and fœtal blood into the closest contact with the mother. Some have even believed that the villi plunge into the tubular follicles, and thence derive their pabulum.

With the formation of the placenta, this contact becomes localized, and, at the same time, owing to the peculiar structure of that organ, is greatly increased in extent. Through the delicate membranes which separate the one system from the other, and in addition to the gaseous supply which constitutes the respiratory function of the placenta, there pass incessantly, in fluid form, materials which go to the building up of the fœtal tissues. But it is not alone by a mere endosmose, or by mutual interpenetration, that this nutritive function is carried on, but by a process of intermediate cell-growth, in the course of which, materials are elaborated, with the express object of fœtal nutrition. Goodsir's theory on this point is illustrated by the accompanying diagram (Fig. 88). His observations led him to the conclusion that the blood in the vessels of the mother is separated from that in the vessels of the fœtus by the intervention of two distinct sets of nucleated cells. One of these, *m*, belongs to the maternal portion of the placenta, lies in contact with, and external to the ultimate maternal vessels, and is

Fig. 88.

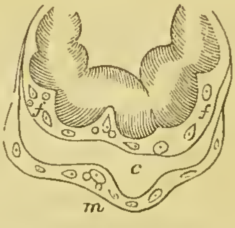


Diagram illustrating Goodsir's theory of Fœtal Nutrition.

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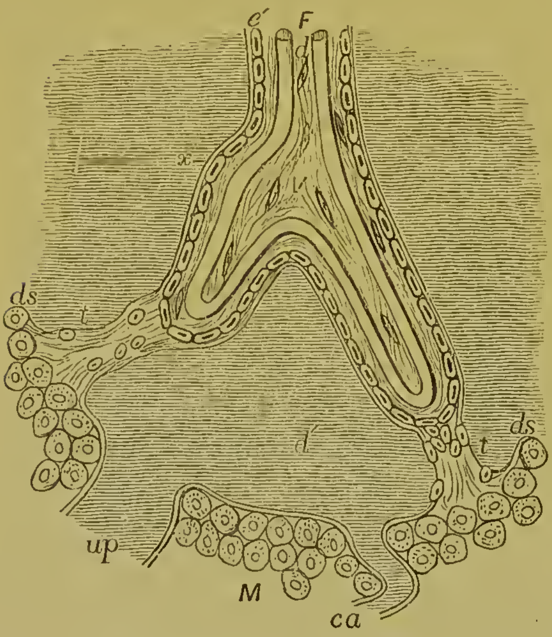
[1] Hertwig seems to be of opinion that the nutritive function of the yolk is insignificant, and that we ought to look upon the umbilical vesicle and its apparatus as a relic of what we have inherited from some reptilian or other ancestor in byegone ages.

probably designed for the separation from the blood of the mother of the materials destined for the fœtus. The other layer, *f f*, lies between the membrane of the fœtal villus and the wall of the vascular loop which it contains, the object of these cells being to receive the material which has been elaborated on the other side. Between the two there is a space, *c*, into which the materials secreted by one set of cells is poured, in order that it may be absorbed by the other. In this way, it is probable that not only are materials passed from the mother to the fœtus, but that, through the same agency, effete or excrementitious matters are transferred from the fœtal to the maternal blood.

Fig. 89.



Structure of the Placenta. (Turner.)

Turner's views, which differ somewhat in detail, go far to corroborate the theories above stated. In Fig. 89 he shows the central blood-cavity (*d′*) into which the curling arteries empty themselves at *ca*, the blood returning from the veins at *up*. The cavity itself he supposes to be formed by an extraordinary dilatation of the maternal capillaries. *t t* represent the union between the maternal and fœtal portions of the placenta, by means of which the cells and their elements communicate. *ds* is the decidua serotina.

Another source from which nutriment has been supposed to be drawn is the liquor amnii. Substances introduced into the stomach or blood of the female have been found in this medium, as well as in the fœtus and placenta, and its analysis has proved it to contain albumen, osmazome, and salts. Besides this, newly born calves have been kept alive by fresh amnionic fluid during a period of fifteen days. This being the case, it has been assumed by some that nutritive material passes by this channel from the mother to the fœtus. The mammary glands, the genital organs, and the alimentary canal, have all been upheld as constituting further mediate channels of communication; but there can be little doubt that such communication, if it occur at all, is most likely to take place through the entire cutaneous surface. This idea finds some degree of confirmation in the observations of Brugmans, who found, on removing the embryo from the amnionic pouch in living animals, that the lymphatic vessels of the skin were in an engorged condition, while those of the intestines, the functions of which had yet to be established, were found to be empty. If we admit that these facts establish the belief in nutrition through the liquor amnii, we see no reason to doubt what Scanzoni asserts, that a similar absorption may take place through the walls of the umbilical cord, and that this would be a more direct way than any to the main channel of the fœtal circulation. Beyond all doubt, however, the main source of nutritive supply to the fœtus is the placenta, while the liquor amnii may be looked upon as an auxiliary medium, through which, possibly, certain special elements may be admitted.

Excretions.—The secretions of the fœtus are similar in their nature to those which are found after independent existence has been established, but are, according to the period of development, in a more or less rudimentary condition. It is necessary to mention here three only, the Bile, the Urine, and the Meconium.

The Liver is, in proportion to the size of the fœtus, and in comparison with the same organ in adult life, a viscus of great size. Prior to the fifth month, its structure is soft and pulpy, and the gall bladder has the appearance of a white cord; but about this period the secretion of the *Bile* commences, the characteristic structure of the liver becomes developed, and the gall bladder begins to distend. It was long supposed that the chief function of the liver at this time was the separation of the hydro-carbonaceous portion of the protein compounds, but it is now believed that this is mainly, if not solely, effected in the placenta. According to Claude Bernard, sugar is found in the fœtal structures in a larger proportion than after birth, even before the formation of the liver, but after the organ is developed there can be no doubt that its glycogenic function is one of its most important offices. At the end of the seventh month, bile makes its way into the intestine, and the gall bladder is usually found distended.

The name *Meconium* is that which has been given to the excremental materials which are contained in the alimentary canal of the fœtus. Up to the third month, the inner surface of the canal presents a slight moisture, but about this period the stomach and duodenum contain a small quantity of whitish albuminous fluid. At the beginning of the sixth month, the contents of the small intestine will be found to have assumed a deep yellow colour, owing to the admixture of bile, which gradually becomes darker in hue as pregnancy advances. The meconium now enters the great intestine, and ultimately, about the end of the term, occupies the rectum in considerable quantity, from whence it is ejected in presentations of the breech, and under various other circumstances which need not be here detailed. The meconium, then, is the result of a mixture of fœtal bile with the material secreted by the mucous membrane of the digestive canal.

The *Urine* is secreted at an early period of intra-uterine life, when the structure of the kidneys is already very considerably advanced. It was at one time supposed that the bladder communicated directly, by the urachus, with a cavity in the allantois, which thus constituted a reservoir for the urine. The allantois, however, in man at least, no longer exists as a cavity at the period when the kidneys form and the secretion of urine begins, so that we are forced to believe, either that the quantity of urine excreted during intra-uterine life is not in excess of the capacity of the bladder, or that the surplus is discharged into the amnionic cavity. That the latter occurs, at least exceptionally, is proved by the discovery of urinary materials in the liquor amnii; but, on the other hand, the existence of imperforate urethra, without any undue distension of the bladder, proves that a periodical discharge of urine is not essential, and establishes the presumption that, as a rule, no such discharge occurs.

CHAPTER VIII.

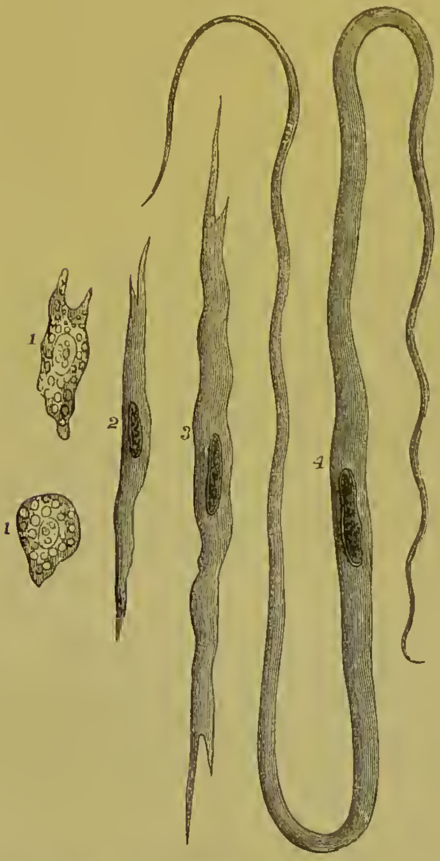
PREGNANCY: SIGNS OF PREGNANCY.

PREGNANCY.—*The Gravid Uterus: Muscular structure: Muscular layers.—Involution.—Development and anatomical relations of Uterus at various stages of pregnancy.*—SIGNS OF PREGNANCY.—*Suppression of the Catamenia.—Digestive disorders: Morning Sickness: Salivation.—Kyestéine.—Changes in the Mammæ: Pain: Enlargement: Secretion of Milk: Areola: Changes in Nipple, and in Glandular Follicles: Secondary Areola.—Enlargement and external appearance of Abdomen: Flattening in early months: Change in the appearance of Umbilicus.—Diagnosis of other Abdominal Tumours.—Vaginal Examination: Colour of Mucous Membrane: Vaginal Pulse.*

WHILE the ovum undergoes, in the progress of its development, the changes which have been detailed, the organism of the mother is also the seat of important anatomical changes and physiological phenomena. Among these, the changes which occur in the uterus naturally attract very considerable attention.

The Gravid Uterus, when we compare it with the unimpregnated organ, presents alterations, not only in magnitude, but in structure. Nothing could be more erroneous than the idea of the old physiologists that its development was a mere distension, similar to what takes place when we inflate an India-rubber bottle. There is, on the contrary, an increase in the quantity of its tissue, whereby its weight is progressively increased up to the end of pregnancy; and there is, moreover, an alteration in the tissues of which it is composed, raising its structure, so to speak, to a higher physiological level. The changes which the mucous membrane undergoes have already been incidentally referred to in connection with the formation of the decidua, and the phenomena of menstruation. In regard to the tissue proper of the uterus, we have found it, in the unimpregnated state, to be composed of interlacing fibres, which are somewhat irregularly disposed. Had no opportunity ever existed of examining them in a gravid womb, it would perhaps have been held a bold speculation to maintain that these fibres are muscular elements of the non-striated variety. In the present state of histological science, nothing is more clearly demonstrated than that this is the case, even if the expulsive contractions of the uterus had not pointed to a similar conclusion. This is indicated with great distinctness in the accompanying illustration, where 1, 1, are nucleated fibre cells from the unimpregnated uterus. Their embryonic or undeveloped condition shows in marked contrast with cells from the gravid uterus, which are shown in 2, 3, and 4, at different stages of development.

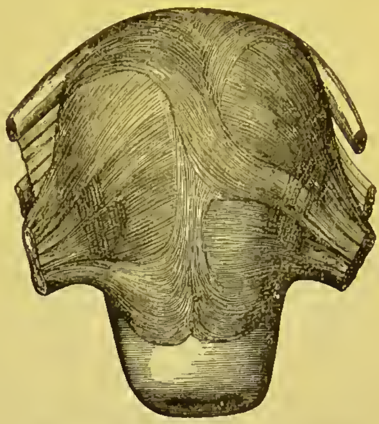
Fig. 90.



Fibre-cells of the Unimpregnated and Gravid Uterus contrasted.

These fibres, which constitute so large a portion of the bulk of the womb, have, from the time of Vesalius, been described by anatomists as forming layers; but the contradictory statements made on this subject by the earliest anatomists, serve to show what may very easily be seen by examining the uterus for ourselves, that the fibres are far from being regular and distinct in their course. This is more especially the case with regard to the unimpregnated uterus; but when conception has occurred, and the fibres have reached the higher stage of development figured above, not only are the fibres themselves more distinct, but their disposition in layers becomes more apparent. It must be confessed, however, that not even the careful dissections of Hunter and Madame Boivin, nor the microscopic researches of Kölliker, have as yet clearly demonstrated what is the exact arrangement of these layers. It may be asserted, no doubt, in general terms, that the fibres are irregularly disposed, in this as in the other hollow viscera, so as to form an external or longitudinal, and an internal or circular group; but when we come to look at the actual drawings upon which these statements are based, we cannot fail to be struck with the fact that, as regards the outer layer, a very small proportion only of the fibres can be truly described as longitudinal. The accompanying cut (Fig. 91) shows the posterior surface of the uterus, from which the peritoneum has been carefully removed, so as to exhibit the external layer of the muscular tissue. It will be observed that the fibres appear to proceed from the sides of the uterus, where they are continuous with those which pass along the round ligament, the broad ligament, the ligament of the ovary, and the Fallopian tube. Their direction therefore is, in the main, transverse; and, when they reach the middle line some of them pass across, interlacing with their fellows of the other side, while a certain number, according to Cazeaux, turn upwards and downwards, after interlacing to form the band of longitudinal fibres which is shown in the figure, and which is continuous with numerous powerful bundles passing over the fundus. A somewhat similar disposition is seen on the anterior surface.

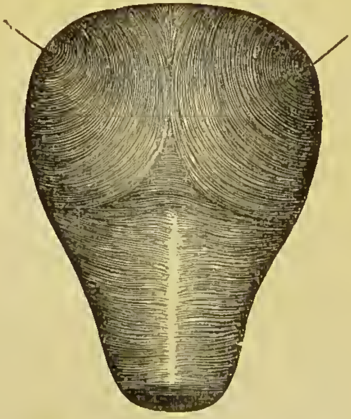
Fig. 91.



External Muscular Layer of Uterus.

The inner layer, as described by William Hunter, and before him, though much less accurately, by Ruysch, is that which corresponds to the circular layer of the other viscera. It is thin, and composed of groups of fibres, the general direction of which is transverse, but arranged at either angle of the uterus, in a concentric manner, around the orifices of the Fallopian tubes, as shown in Fig. 92. Other groups encircle the middle of the body of the uterus, while others again are described as forming a sort of sphincter surrounding the os uteri, a powerful and special band of them, at the level of the os internum, constituting what is known as the ring of Bandl. Between these two layers, a third or middle layer is generally described by modern anatomists, as being of considerable strength and thickness, with numerous bundles, flattened, and running in all directions in the substance of the organ. These interlace freely, and surround the vessels of the uterus, so that, when the organ is in a state of contraction, those vessels must be notably diminished in their caliber.

Fig. 92.

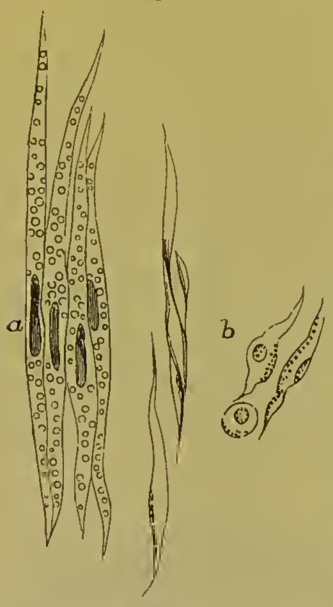


Internal Muscular Layer of Uterus.

Indeed, there is every reason to believe that it is mainly by their agency that hæmorrhage is prevented after the separation of the placenta, the ruptured and gaping orifices of the utero-placental vessels being thereby closed.

Involution.—Inseparably connected with the subject which we are now considering, is that of the involution of the uterus, or that process whereby the organ returns, after delivery, to a size and structure approaching that of the unimpregnated state. That the uterus, in a short time, is reduced in weight from about twenty-four ounces to two, involves the certainty that rapid absorption takes place under very special conditions. How this takes place has been indicated by many physiologists, but by none has it been demonstrated so clearly as by Kölliker. The enormous fibre-cells which exist at the termination of pregnancy, are now huddled together in contraction, and, their function being over, absorption takes place, under favourable conditions, with great rapidity. They become the seat of rapid atrophy and fatty degeneration, and the whole mass of the muscular tissue becomes soft and friable. The separation of individual fibres for microscopic examination is, on this account, not easy; but, if successfully removed, they will be found as indicated in Fig. 93, where the appearance presented by them a fortnight after delivery is shown at *a*. About the fourth week, the development of new fibres in various stages, *b*, may also be observed. A large portion of the fatty and disintegrated matter is removed by the vagina in the lochial discharge, while a proportion still larger is probably absorbed into the circulation, and discharged ultimately from the system by the ordinary excretory channels. The latter has been supposed to contribute to the formation of the caseous matter in the milk first secreted.

Fig. 93.



Degeneration of Fibre-Cells after Delivery.

That portion of the peritoneum which invests the uterus and neighbouring parts is evidently so disposed, in the unimpregnated state, as to admit of free extension during pregnancy. It is in this way that the broad, as well as the anterior and posterior ligaments unfold themselves, as the uterus slowly develops, until, at last, they entirely disappear. But it is not by a mere mechanical process such as this, that the serous covering of the womb adapts itself to the exigencies of the pregnant state, but, in addition, by an actual hypertrophy of its tissue. Were the former alone the case, the extension thus furnished would not be possible without thinning of the membrane; but as we invariably find that, at the very end of pregnancy, the membrane in question is as thick as before, we infer that in this case, as in large herniæ and certain other morbid conditions, the serous, as well as the muscular and mucous coats of the womb, undergo marked hypertrophy.

The Uterus during Pregnancy.—The development of the ovum within the womb, the various stages of which we have traced, is necessarily accompanied by a corresponding increase in the volume of the uterus, and by marked changes in its anatomical relations. In the shape of the organ there is, from the first weeks, a marked alteration in respect of the antero-posterior flattening; and, as the pregnancy advances, the general form approaches more a spheroidal than a pear shape. From the twelfth to the twenty-fourth week, the cavity assumes more and more of a rounded appearance, while still retaining a certain amount of the antero-posterior flattening: its length also is somewhat greater than its width, and, speaking in general terms, the cavity of the uterus may, at the last named period, be described, as it is shown in the diagram (Fig. 94), as globular. During the remaining sixteen weeks of gestation, the rounded shape of the uterine cavity becomes changed into an oval, so that at the end of pregnancy the womb is about twelve inches long, nine broad, and eight from before backwards. This change was formerly believed to be effected in all cases by a progressive invasion of the canal of the cervix from above downwards. The numbers 30, 36, and 40, are thus supposed to represent, by the dotted lines, the extent to which, at these weeks, the uterine cavity has increased at the expense of the cervix. The crosses mark upon the uterine wall the site of the original os internum. To this subject, and more particularly to the state of the os and cervix as a sign of pregnancy, we shall revert.

Fig. 94.

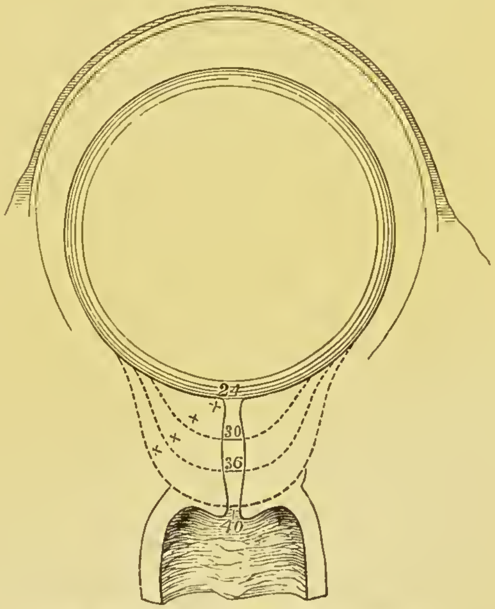


Diagram showing Development of Uterine Cavity. (After Schultze.)

These alterations in the form of the uterus, must needs be accompanied by changes, no less marked, in its situation and anatomical relations. During the first twelve weeks of gestation, the womb remains within the true pelvis, or cannot, at least, be felt above the pubes, although, on pressing the fingers somewhat deeply, or by bi-manual examination, it may be readily discovered. Seeing that the fundus is originally very near the level of the brim, it follows that the considerable increase in bulk which these weeks bring must find room in another direction. We find, therefore, that the development, under the circumstances, goes on in a downward direction, and that the os and cervix are discovered, on examination, to be nearer the floor of the pelvis than they were before impregnation. It thus obeys, so far, the laws of gravity, and the weight of the intestines resting upon the fundus may, in some measure, contribute to the result. The progress of fœtal growth soon renders it impossible for the uterus and its contents to remain longer within the pelvis; and if, under peculiar circumstances, it is retained there, the safety, both of mother and child, is immediately endangered.

In the course of the fourth month, the fundus can usually be felt by the finger of the accoucheur, above the pubes. The level which it attains at various periods of pregnancy depends upon the condition of the abdominal walls, and upon many other circumstances which render exact statements upon this subject impossible. Very generally, it will be found to have attained the level of the umbilicus some time in the course of the sixth month. About the thirty-sixth or thirty-seventh week it reaches the level of the xiphoid cartilage; but between this time and the end of pregnancy, it falls downwards and forwards, preparatory to the phenomena of parturition.

Anatomical Relations of Gravid Uterus.—In rising from the pelvis, and going through the succeeding stages of its development, it is easy to understand how the uterus, with a tendency towards the right side even in the unimpregnated state, will be still more encouraged in its movement in that direction, by the prominence of the vertebral column in the middle line.[1] If we reflect further that the line which represents the axis of the uterus, is nearly coincident with the axis of the brim of the pelvis, and remember the marked projection of the lumbar vertebræ, we shall have no difficulty in appreciating the causes which lead to the uterus being in immediate contact with the anterior abdominal wall, so that it is a rare occurrence when we find any portion of the intestines intervening between the abdominal and uterine walls in this situation. At the termination of pregnancy, then, the uterus, with the ovaries, Fallopian tubes and other structures closely applied to its side, occupies a great part of the abdominal cavity. Its usual relations are as follows :—in front with the vagina, the neck and posterior wall of the bladder, and the anterior abdominal wall; behind, with the rectum and the promontory of the sacrum below, and the mesentery and the intestines above; on the right, by the cæcum and the right abdominal wall; and, on the left, by the sigmoid flexure of the colon, and, usually, the great bulk of the small intestines.

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[1] It has been held, among other causes which have been advanced to account for this displacement to the right, that the weight of the placenta gave rise to it,—it being more frequently, according to Levret, on the right side. The presence of the descending colon on the left, the habitual use of the right hand in preference to the left, and the habit of lying on the right side during sleep, are a few among the other reasons which have been propounded to account for the phenomenon.

Signs of Pregnancy.—The development of the womb, and that already described of the germ which it contains, constitute the essential anatomical and physiological phenomena of the pregnant state. Associated with it, however, and dependent upon its continuance, are numerous other manifestations, which have their seat in organs so remote, that it is difficult, in many cases, to trace the sympathy which exists between them and the special organs of generation. There is, in point of fact, no single function of the whole economy which may not be affected by the operation of a cause which has its centre in the generative organs, and which radiates thence throughout the entire system. Consequently, phenomena are frequently observed in distant organs which are certainly not associated in function with the womb, but so constant is the occurrence of these phenomena, that they have come to be familiarly looked upon as among the early symptoms of pregnancy. More important are the symptoms which have their cause and seat in the generative organs; but, in the observation even of these, there are, as in the case of the others, so many sources of fallacy, so many pitfalls of error, that obstetrical writers, have uniformly, and with obvious propriety, made a study of the Signs of Pregnancy,—one of the most prominent subjects to which it is desirable that the attention of the student in this department should be drawn. We can conceive no subject in regard to which a mistake might so utterly ruin a young man's hopes, as the determination, in delicate or doubtful cases, of this question of pregnancy. An obvious pregnancy overlooked, because the idea has never crossed the mind, is bad enough, and we have known a practitioner of thirty years' standing blister the abdomen in the ninth month, under the idea that he was treating a morbid growth. But what is far more inexcusable, is the culpable rashness of those who, without irrefragable evidence of the existence of pregnancy, would venture—as has been done in high quarters—to brand a woman with the stigma of dishonour.

To enable the practitioner to avoid these and similar errors, the symptoms which indicate pregnancy have been arranged, with a view, more especially, of assigning to each its actual diagnostic value, and determining the period at which, in the course of a pregnancy, it is available. We shall find that the number of symptoms which are of themselves conclusive as evidence of pregnancy is very limited ; but the other, and more numerous group, constitute an important chain of circumstantial or corroborative links, which, under ordinary circumstances, enable us to admit the strongest probability of an event which may be either dreaded or longed for. The convictions of a woman whose most earnest desire is to be a mother, and the passionate asseverations of another whose chastity is called in question, are disturbing elements which tend to throw us out in our calculations, and must always be taken *cum grano.*

In classifying the Signs of Pregnancy, various plans have been adopted, but what seems more rational, and what certainly is much more satisfactory than any attempt at rigid classification, is to take up the symptoms, as nearly as may be, in the order in which they are manifested. The earliest of all the symptoms have their seat in the generative organs, but are of little value from a practical point of view, inasmuch as they consist in physiological and anatomical manifestations which are almost entirely beyond our ken. It is certain that the fertilized ovum, on its arrival within the cavity of the uterus, finds that organ in a condition suitable for its reception. Probably, the conditions which we have seen to exist, in ordinary healthy menstruation, as regards the tissues of the womb, are, under the special circumstances of conception, prolonged, and ultimately pass, by a series of developmental changes, some of which have been described, into those which are characteristic of the more advanced stages of pregnancy. Or, supposing even the uterus to be quiescent, and not under the influence either of a past or of an impending menstrual molimen, we may assume that one of the earliest effects of impregnation is a marked congestion and hypertrophy of all the uterine structures ; changes which, though easily enough demonstrated after death, are not so easily appreciated during life, and are in reality of little actual diagnostic value. Still, the increased weight and heat of the uterus, the increased resistance in the upper and anterior wall of the vagina,—due, it has been said, to a slight anteversion of the womb usual at this period,—may, along with other symptoms, excite in the mind of the experienced practitioner suspicions which, under other circumstances, might not have arisen.

Suppression of the Catamenia.—This is generally the first symptom which attracts the attention of a woman who admits to herself the possibility of impregnation. Although this undoubtedly is a remarkably constant occurrence, it is by no means invariable. It has, however, a special interest, apart from its value as a sign of pregnancy, in the fact that it is from the last appearance of the menstrual flow that women are in the habit of calculating the period at which the birth of a mature child will probably take place. What detracts more especially from its value as an evidence of impregnation, are the remarkable aberrations which, under such circumstances, not unfrequently occur. It is far from being a very uncommon occurrence that, during the early months of pregnancy, the catamenia, or at least a periodical sanguineous discharge, makes its appearance much as usual. Cases in which this occurs up to the fifth or sixth month, are of much less frequent occurrence; and fewer still are the instances in which, from the beginning to the end of pregnancy, the menstrual discharge apparently goes on as usual. Moreau is probably correct in assuming that, in these cases, the source of the discharge is not the same as in the ordinary menstruation; but, as regards the import of the symptom, this is a mere speculation, and of no practical significance. Cases are on record also in which women menstruated only during pregnancy, menstruated for the first time after impregnation had taken place, or became pregnant without ever having menstruated at all. The last case, which is extremely rare, is analogous to what takes place in those instances in which women who are nursing again become pregnant, without ever having menstruated since the previous accouchement. The converse of these cases, and what goes still further to lessen the value of the suppression of the catamenia as a sign of pregnancy, is to be found in the very numerous examples which occur in every-day practice, of patients in whom the discharge is suppressed, as the result of certain morbid conditions affecting, more or less directly, the generative organs. A similar result may obtain, and that even more frequently, in those instances in which the suppression is the result of constitutional causes, in themselves apparently quite independent of the generative functions. And, in a few rare cases, there is a suppression of the menstrual discharge without any appreciable cause, local or general; but it cannot be doubted that in these the only peculiarity is, that the cause is hid from us. It should be remembered, as a fact of by no means very rare occurrence, that newly married women may cease to menstruate during several periods, as a result apparently of mere sexual excitement unconnected with impregnation. It is in the highest degree probable that these deviations from the normal standard, are due to unusual conditions of the ovary, which in one class of cases we may venture to assume as being unduly stimulated to attempts at ovulation, during a period at which that function should naturally be in abeyance; while, in another class, its function is arrested by causes which may act upon the ovary, either specially through the generative apparatus, or constitutionally through the general system.

Morning Sickness.—The Digestive Organs are, during a pregnancy, the seat of various derangements of function, evidently depending on the sympathy which subsists between these upon the one hand, and the womb on the other. Although the exact period at which such symptoms develop themselves varies greatly, there is scarcely a single case of pregnancy, in which, at some time or other, symptomatic digestive disorders do not manifest themselves. The most frequent of all is nausea, generally accompanied with vomiting, and this being of much more frequent occurrence in the morning than at any other time of the day, has given to the symptom this familiar designation.

In the absence of any special cause which might give rise to nausea or vomiting, and if the general health apparently remain good, this sign is sometimes of considerable value. It is generally, however, to the early months that this nausea is limited, and it usually terminates or is mitigated about the time that the fundus may be observed above the pubes, having commenced probably about the fourth or fifth week. The period of development, and the duration of this symptom, are subject to great irregularities, in one case, it may be, beginning with the first days of pregnancy and continuing to the last, while in others it does not commence until an advanced period, when local irritation of the stomach is more likely to be the cause. We have seen cases in which, at first, morning sickness was as marked as usual: to this succeeded a period of immunity, extending over several months, the nausea returning with great discomfort to the patient during the last weeks, being probably due in the first instance to sympathy, and in the latter to the effect of proximity of the organs. Associated with the more familiar symptom of morning sickness, are others which also have their origin in the digestive system, such as heartburn, pyrosis, epigastric pain, and troublesome eructations. Repugnance to various articles of diet, which possibly were relished before pregnancy, or a longing for unusual, and even deleterious or disgusting substances, such as occurs in chlorosis, are by no means unusual symptoms. The signs manifested during one pregnancy are no sure criterion of their probable form in another, for we often find that a woman, who has suffered intensely in her first pregnancy from these digestive disorders, is on subsequent occasions remarkably free from them; nay, it may happen that women, who have never had morning sickness, complain of it for the first time on the occasion of a fifth or sixth pregnancy. All the affections alluded to constitute, when excessive, morbid conditions, and as such fall to be considered as disorders of pregnancy.

Salivation.—This, although not a symptom of any practical importance, is occasionally so marked in degree as to constitute a prominent feature in the case. In this, there seems to be a special glandular sympathy manifesting itself in a hypersecretion, which may last during the whole term of pregnancy.

Kyestéine.—Under the same category of phenomena which have their origin in the glandular system, we may here notice certain changes in the urine which, since the time of the ancients, have attracted attention as symptomatic of the pregnant state. Many years ago, a number of observers directed their attention to the investigation of this subject, but the person whose name is most intimately associated with it is M. Nauche, by whom the name was given to the substance referred to. From the numerous observations which have been made, by him and others, it would appear that the period of pregnancy at which this has been discovered varies considerably; that it is certainly not present in all cases of pregnancy; and that it has been discovered in certain morbid conditions which have no relation to the pregnant state. This, of course, reduces the value of kyestéine as a sign of pregnancy to a low level; but there can at the same time be no possible doubt, that in a large proportion of cases the substance may be discovered. When the urine is fresh from the bladder, there is no appearance whatever which would enable us to distinguish it from the ordinary excretion. About the third day, or sooner, it commences to lose its transparency, and becomes hazy, as if mucus were suspended in it, and, shortly afterwards, distinct traces may be seen, on the surface, of the formation of a pellicle, which is at first thin and transparent, but subsequently becomes much thicker and more opaque. About the third or fourth day, the distinctive characters of this pellicle usually reach their greatest intensity, and little flocculent portions then commence to detach themselves from its under surface, and sink through the liquid to the bottom of the vessel. The whole pellicle ultimately goes through this process, and becomes thus transformed into a whitish deposit which gravitates to the bottom, as did the flocculi first detached. The original pellicle is then replaced by another, which contains, as indeed may the first one, crystals of triple phosphate; the liquid becomes more turbid, until, finally, the appearances characteristic of pregnancy become lost in the process of putrefaction. Kyestéine, then, first makes its appearance in the urine under the form of a cloud, like cotton in suspension, which is due to the aggregation of little globules which exist in the urine when passed.

These subsequently unite, rise to the surface, and constitute the pellicle which we have described. It is said that, when present in the urine, it persists from the end of the first month until delivery; but the observations of Cazeaux throw much doubt on this assertion, as regards the last six weeks, for he tells us that he examined in 1849 the urine of fifteen women at this stage of pregnancy, without discovering any trace of it. Chemical and microscopical researches seem to show that Kyestéine is a new formation, and is an azotized substance, and that it presents itself under the form of minute globules. As a sign of pregnancy it is of little or no value.

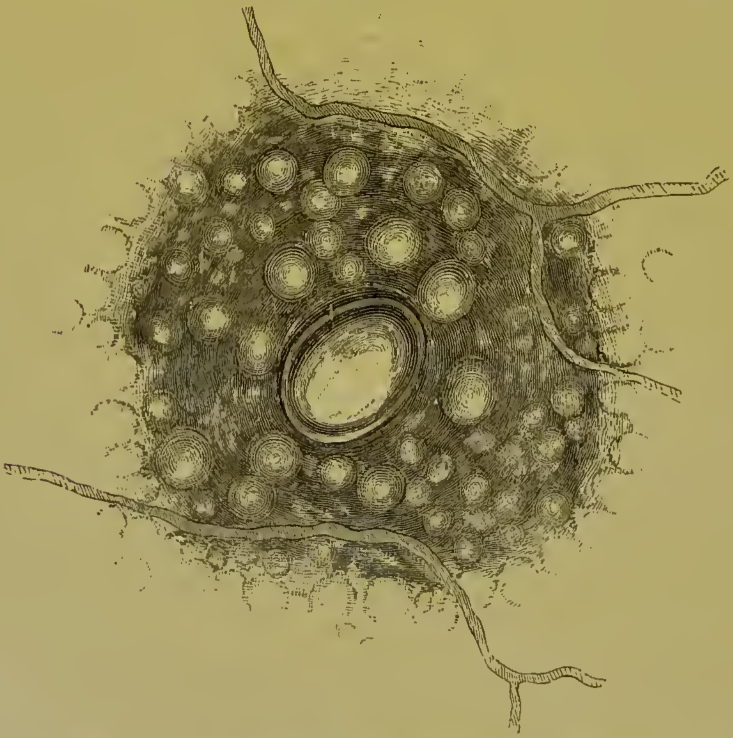
Changes in the Mammæ.—The Mammæ are, from an early period, the seat of certain symptoms and changes, which are justly looked upon as of great importance. When we reflect on what their proposed function is, we cannot marvel that, even thus early, they become the seat of changes, which are evidently designed with the view of elaborating, and otherwise preparing, these important structures against the time when they will be called upon to discharge the function in question. The earliest indications which are given by the mammæ of the existence of pregnancy, are certain vague sensations, which are described by the woman as of fulness and weight, but which not unfrequently amount to considerable uneasiness, and even acute pain. This points to the awakened activity of the organs, further evidence of which is soon shown in a considerable increase of volume, due obviously to the greater afflux of blood, which dates from the earliest weeks, and which manifests itself at a more advanced period by the presence of large blue veins, which may be seen coursing under the skin, more conspicuously in a woman of a blonde complexion. To the touch, the gland seems harder than usual, and here and there may often be felt clusters of enlarged milk vessels, which give the impression of knotting. Towards the end of pregnancy, or at a much earlier period if the distension of the mammæ is extreme, silvery white lines are seen upon the surface of the breast, radiating from the nipple as from a centre. These arise from distension of the cutaneous structures, and yielding of the corium at some points, so as to give facility to the expansion due to growth of the gland.

The secretion of milk in the breasts has very generally been supposed by the vulgar to be an infallible sign of pregnancy, either past or existing. The facts however do not warrant such a conclusion; but, at the same time, the presence of milk in the ducts is, when taken along with other signs, often of considerable importance. It is proper to mention, however, that not only is milk in the breasts no certain sign of pregnancy, but numerous cases are recorded by Montgomery and others, where the breasts of young women who had never been pregnant, and of old women past child-bearing, have yielded milk in sufficient abundance to suckle a child. A striking case of this nature was narrated to the writer by Dr. Livingstone, the renowned African traveller, who had so investigated the circumstances as to eliminate even the possibility of doubt. A native woman was delivered of twins, and not being constitutionally very robust, was unable to nurse both, whereupon the grandmother, a woman of sixty, took one infant, when, after repeatedly placing it to the breast, the secretion was so abundantly established that she proved an excellent nurse. Nay, more than this, there have been cases in which the gland in the male has secreted milk in considerable abundance.

Areola.—Surrounding the nipple, and circumscribed by a circle of about three fourths of an inch radius from its centre, the skin presents, in the adult and unimpregnated condition, a peculiar appearance, which consists chiefly in an increased depth of colour. It is thin and delicate, and presents to the eye the semblance of a structure intermediate between skin and mucous membrane. From its surface, small glandular eminences, varying in number from twelve to twenty or more, may be seen to project slightly. This area, which is called the Areola, is the seat during pregnancy of changes which are frequently of the greatest importance in strengthening the presumptive proof which may already exist; but it must always be remembered that changes, closely resembling those which we are about to describe, may be produced by causes which have their seat in the generative system, but which are independent of pregnancy; and, moreover, that as the changes are to a considerable extent permanent, it is in first pregnancies that they have the greatest diagnostic value. The following are the appearances referred to:—If the breast be carefully examined about the ninth week, a considerable increase in the size of the nipple will almost always be observed, this structure having become turgid, and, as it were erect. Simultaneously with this, or closely succeeding it, there is a deepening in the colour of the areola, an increase in its diameter, and a greater prominence and development of the follicles which stud its surface. It participates, obviously, in the increased vascularity of the nipple, and becomes, like it, moist and turgid. The alteration in colour which is due to this turgescence takes place in all cases, but it is only in women of dark complexion that the characteristic changes of the areola are to their fullest extent manifested. In these, there is an actual deposit of pigment, and the depth of the colour is, towards the termination of the pregnancy, not unfrequently such as to present a most striking and peculiar appearance. Examination of the follicles has shown that they are possessed of excretory ducts, through which their secretion may, under certain circumstances, be expressed.

Secondary Areola.—At a period not earlier than the fifth month, there may generally be observed, in women in whom the areola is deep in colour, some trace of what Montgomery has described under the name of Secondary Areola, and to which he attached great diagnostic significance, amounting indeed, in his opinion, to a certainty of pregnancy independent of other signs. This areola, which immediately surrounds the other, is, even when most distinct, very faint in colour, and has been well compared to the effect produced by drops of water falling upon a tinted surface, and discharging the colour. An attempt has been made in the accompanying cut (Fig. 95) to indicate the various appearances referred to.

Fig. 95.



Areola and Secondary Areola in Seventh Month of Pregnancy. (After Montgomery.)

The pigmentary deposit, on which the appearance of the areola of pregnancy in a great measure depends, is not in every case limited to the situation in question. In a large proportion of cases, a dark line, about a quarter of an inch in width, may be observed running along the middle line of the abdomen, from the symphysis to the umbilicus, and occasionally extending from thence as far as the ensiform cartilage. A dark-coloured disc, occupying and surrounding the umbilicus, was occasionally observed by Montgomery, and is described by him under the name of the "umbilical areola"; and brownish streaks, analogous to the silvery lines in the breast, are usually to be seen in the abdominal walls, running parallel to each other, and generally curved, with the convexity towards the groins. These streaks lose their colour but do not disappear after delivery, and are therefore of some medico-legal importance in determining the question of previous pregnancy. As an occasional concomitant of pregnancy, there has also been observed a more general discoloration of the skin, so much so, indeed, as to give rise, in one case at least, to the suspicion of existing disease of the supra-renal capsules. In the case in question, the whole forehead, and part of the cheeks, neck, and breast, was deeply tinged of a yellowish brown colour; but within a few weeks after the birth of the child this had completely disappeared, nor was there at any time the slightest symptom, in addition to the discoloration, to encourage the belief in the existence of the disease of Addison. In other instances, discoloration of the skin during pregnancy has been found to be due to the presence of *pityriasis versicolor.*

The appearance of the abdomen, although a very conspicuous sign of pregnancy, can only be admitted as such on the careful exclusion of certain sources of fallacy. For not only may solid tumours of various kinds give rise to appearances very similar, but fluid accumulations, such as ovarian cysts or dropsical effusions, or even distension of the bladder, may delude the unwary into a hurried and erroneous diagnosis. It behoves the observer, therefore, to be careful how he admits this point in evidence. Cessation of the menses, with abdominal enlargement, would almost certainly be admitted by an expectant mother and her friends as proof sufficient; but it sometimes falls to the duty of the medical attendant to dispel such illusions. Passing over, for the moment, the evidence to be derived in such cases by the practice of palpation, a certain amount of information may be obtained by the eye alone, in examining the abdomen in the various stages of pregnancy.

As we have already seen, the uterus, during the early weeks of pregnancy, instead of rising upwards into the abdominal cavity, falls rather downwards towards the floor of the true pelvis. This fact is said to give rise to the earliest modification in the outline of the abdomen, consisting, not in an enlargement as might have been expected, but in a slight flattening of the hypogastric region. This fact has been long recognised, and, although its importance has been greatly exaggerated, its expression is embodied in the old French proverb, quoted by all writers, "Ventre plat, enfant y a." As a symptom of pregnancy, it is, we believe, valueless. Actual abdominal enlargement dates from about the thirteenth or fourteenth week, but so much depends upon the figure of the woman, the number of children she has borne, the presentation of the child, and the quantity of liquor amnii, that the mere study of the abdominal outline would, in so far as uterine development is concerned, rarely afford us reliable information.

Changes in Umbilicus.—Another observation which should be made, consists in a careful examination of the umbilicus. During the first three months, the depression of the navel is undisturbed. In the course of the fourth month, it becomes less hollow than before conception, and, from this time, the depth of the cavity becomes gradually diminished until, about the seventh month, it becomes completely effaced, and is on a level with the surrounding skin. Nor do the changes of the umbilicus cease here, for during the two last months it protrudes beyond the surface, being, as it were, inverted by the pressure which is brought to bear on the inner surface of the abdominal wall by the distending womb. This is a pretty constant sign, and is certainly one of the most important to be derived by an ocular observation of the abdominal surface; but similar phenomena, it must be remembered, may be caused by ascites and tumours.

Other Abdominal Tumours.—In so far as external appearance is concerned, there is scarcely any variety of solid tumour connected with subjacent organs, nor even any tumour due to fluid or gaseous distension, which may not, under certain circumstances, give rise to the suspicion of pregnancy. It is rare, in practice, that the differential diagnosis of such affections presents any great difficulty, but there are cases in which difficulties undoubtedly exist, when recourse must be had to percussion and palpation, to remove such doubts as may arise. Such an examination enables us to determine the shape and limits of the tumour, and the relation which it bears to the bowels and other surrounding parts. Nothing is here of such importance as the consistency of the tumour. The extreme hardness of uterine myomata, on the one hand, and the yielding softness of gaseous or fluid distension on the other, represent the extremes, between which endless varieties exist. But the uterus, when distended, communicates to the hand a feeling so peculiarly its own, as to enable any one possessed of the requisite *tactus eruditus* to pronounce on the subject almost with certainty. This feeling consists in a certain elasticity which, although it may be simulated, is different from that which is communicated by any other form of abdominal tumour. Besides this, the practice of palpation often causes a certain amount of feeble, painless contraction in the womb, which, when distinctly felt, is of the highest diagnostic value; but it must be remembered that these symptoms prove only that it is the uterus which we are touching, and are no evidence of pregnancy. If, however, we are convinced that the elastic tumour contains a solid movable body, there is scarcely any room for doubt. In cases where, from unusual thickness of the abdominal walls, or from some other cause, palpation gives obscure results, the history of the tumour, and, especially, the situation in which it was first observed, are points which may have special value. If ovarian, the tumour may perhaps have been observed, in the first instance, in either groin: if from the spleen or liver, the history will be of a growth developing from above downwards, instead of the globular uterine swelling, first observed in the middle line behind the symphysis, which steadily increases in an upward direction, and the nature of which is probably revealed by other important symptoms, some of which have already been detailed. In those cases in which the tumour is proved to be the uterus—but the fact of pregnancy is still in doubt—there is always the possibility of the cavity being distended by other contents. Actual difficulty, even in experienced hands, and error in diagnosis, are most likely to occur in those cases in which pregnancy co-exists with some of the morbid affections above alluded to. We may have, for example, clear evidence of ovarian disease—a tumour, we shall suppose, partly cystic and partly solid, springing from either groin, and slowly increasing in size. In such an instance, on the occurrence of pregnancy, the abdominal tumour will increase with much greater rapidity; but, one cause of abdominal enlargement having already been established, the possibility of a co-existing cause may quite slip out of notice, and thus very serious mistakes have, in some cases, actually been made. When we come to consider the diseases and complications of pregnancy, we shall find that there are many other morbid conditions, which, when associated with it, tend greatly to obscure the diagnosis.

Vaginal Examination.—Important information, either positive or negative, is afforded at all stages of pregnancy by a vaginal examination. In the early months, the descent of the uterus causes an apparent shortening of the vagina and an increase in its width from side to side; but, from the end of the third month till towards the end of gestation—when, as we shall see, the womb again falls downwards—the extension of the vagina upwards results in an elongation and a consequent proportional narrowing of its diameters. There is clear evidence here also of increased activity of the circulation, corresponding to that which we have found to exist in the internal genital organs. It takes the form, in this situation, of a venous engorgement, which is due, in part at least, to obstruction, caused by pressure of the gravid womb, and is indicated by a more or less livid colour of the mucous membrane —very different from the rose colour of the unimpregnant state. This ocular examination of the parts, although it may thus reveal a sign which is far from being the least important, is, for obvious reasons, a method of research which cannot be generally adopted in the practice of midwifery, so that we have to depend here upon the results which are afforded by an examination conducted, under the bedclothes, by the finger.

Vaginal Pulse.—Under the head of digital examination, the first symptom which often comes under our observation is one which is due to the increased vascularity of the parts to which reference has just been made, and consists in strong pulsations, which are obviously due to enlargement of the vaginal arteries. This, which is a sign of no great importance, has been described by Osiander under the name of vaginal pulse.

During the later months it is by no means unusual to find the mucous membrane hypertrophied and covered with small granulations or papillary projections, which are supposed to be the result of an abnormal development of the mucous follicles, and which are, certainly, often accompanied by an augmented mucous secretion. The chief, and in many cases, the sole object of vaginal examination is to ascertain the condition and anatomical relations of the inferior segment of the uterus, and, more especially, the state of the os, and of that portion of the cervix which projects into the vagina. In those early weeks, during which the uterus descends within the cavity of the true pelvis, the descent is accompanied by a certain amount of anteversion, which enables the experienced accoucheur, as early as the sixth week, to recognise in the anterior vaginal cul-de-sac a fulness or slight resistance, which is absent in the normal and unimpregnated condition of the parts. This no doubt may be due to simple bulging of the anterior uterine wall consequent upon distension of the cavity, but the view generally entertained is that it is caused by a more marked development of the bending forward of the uterine axis which is believed to exist even in the unimpregnated organ.

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CHAPTER IX.

SIGNS OF PREGNANCY (CONTINUED).

Changes in the Os and Cervix Uteri: Progressive Softening: Characters at Various Stages.—Position of Os in Relation to Pelvic Walls.—Digital Examination or "Toucher."—Examination per Anum.—Quickening: Fœtal Movements Observed, (a) by the Mother, (b) by the Accoucheur.—Ballottement or Repercussion.—Fœtal Pulsation.—Funic Souffle.—Uterine Souffle: Theories as to its Production.—Stethoscopic Examination of Fœtal Movements.—Division into Certain and Probable Signs.—Tabular Résumé of the Signs of Pregnancy.

Os and Cervix Uteri.—It is from the observation of these parts that the most important information is derived in the course of a vaginal examination; for not only does this give us indications of pregnancy at a very early stage, but it enables us in many instances to judge, approximately at least, of the stage which the pregnancy has attained. From a very early period of gestation, a difference takes place in the firmness and resistance of the cervical tissue, which is due, in the first instance, to the congestion and hypertrophy of which this, as well as the other portions of the uterus, are, immediately after conception, the seat. But in addition to this, there is a special change, which a few careful examinations by the finger will enable any one to recognise, and which is admirably described by Cazeaux. "Towards the end of the first month," he says, "one may already discover that, in addition to the first general modification, that portion of the lips of the os which is situated most inferiorly, or rather most superficially, begins to soften. This appears to be rather an œdematous condition of the mucous membrane, than an actual softening of the tissue proper of the lips, so that, in pressing slightly upon the thick and softened membrane, the finger at once perceives its fungous softness, but seems immediately afterwards to reach the tissue proper of the neck, which still retains its normal consistence. The sensation thus conveyed closely resembles that which we obtain if we press with the finger upon a table which is covered with a thick and soft cloth. It is not till towards the termination of the third month, or the beginning of the fourth, that the entire thickness of the lips of the os is softened, to the extent of two or three millimeters. From the fifth month, the softening extends from below upwards, and, at the sixth, reaches the centre of the vaginal portion of the cervix. During the three last months, it invades, step by step, the superior part, until it reaches the internal os, so that at the end of pregnancy, the neck is so soft, in the case of certain women; that I have often observed that students had great difficulty in distinguishing it from the walls of the vagina." This, according to the distinguished accoucheur whom we have quoted, is very constant in its occurrence, and should be looked upon as a very important sign of pregnancy, unless it be in cases where the tissue of the cervix is the seat of pathological alterations.

The shape of the os and cervix also undergoes, during the advance of pregnancy, some very remarkable changes. The os very early loses the form of a transverse slit, and becomes more circular in form, while the comparative softness of the tissue admits sometimes of the introduction of the point of the finger. This becomes much easier as pregnancy advances, while the softening process described by Cazeaux extends, so that, by the sixth month, it is occasionally possible to introduce the finger for some little distance. A reference to the diagram already shown (page 156) indicates the manner in which, according to the ideas originally entertained by Désormeaux, the canal of the cervix is invaded, in the march of development, by a process of encroachment from above downwards, dating from the sixth month, or, according to some, even earlier. It requires, however, no very extensive study or observation of the facts to show that no such simple description will afford a satisfactory explanation of the facts as they come under observation in practice. A shortening, or apparent shortening, of the vaginal portion of the cervix is, more especially in primiparæ, undoubted; but are we entitled to accept this observation as conclusive, or even as corroborative, evidence of the views of Désormeaux? No one, we should imagine, can hesitate, on reflection, to answer this query in the negative; but yet we can scarcely doubt that this has been accepted by many as sufficient evidence of the doctrines to which they subscribe.

This theory, although so convenient in its simplicity, is one which many writers, both of the past and the present century, have found it impossible to adopt; but, unfortunately, of the dissenters, no two seem to have reached precisely the same conclusions. In fact, this, so far from being a simple matter which admits of clear demonstration by a few

DIAGRAMS SHOWING (ACCORDING TO SCHULTZE AND OTHERS) THE RELATION WHICH THE CANAL OF THE CERVIX BEARS TO THE CAVITY OF THE UTERUS DURING PREGNANCY.

PRIMIPARÆ.

PLURIPARÆ.

Fig. 96.

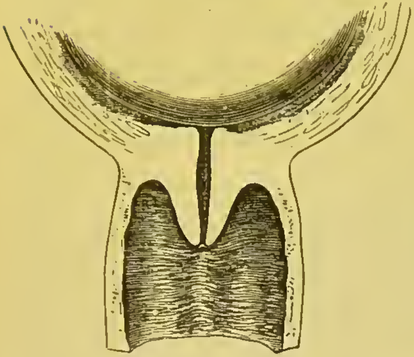
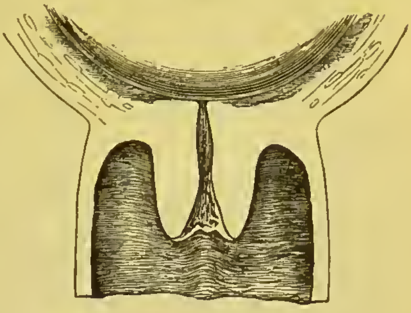


Fig. 99.



Twenty-fourth Week.

Fig. 97.

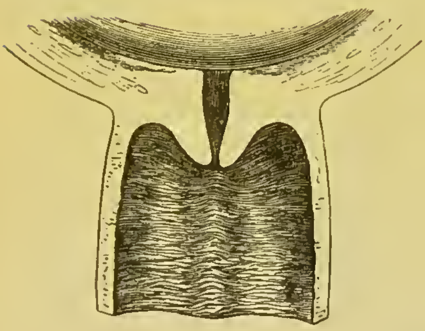
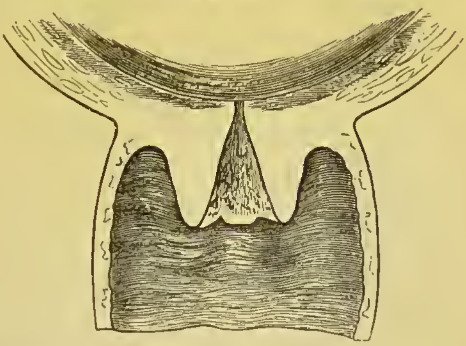


Fig. 100.



Thirtieth Week.

Fig 98.

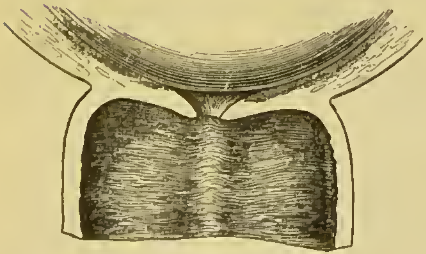
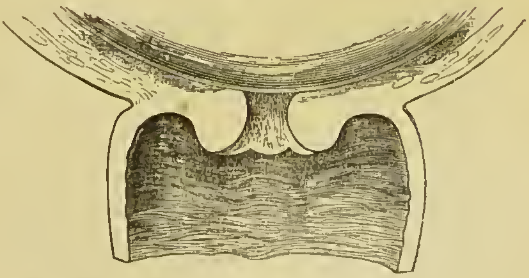


Fig. 101.

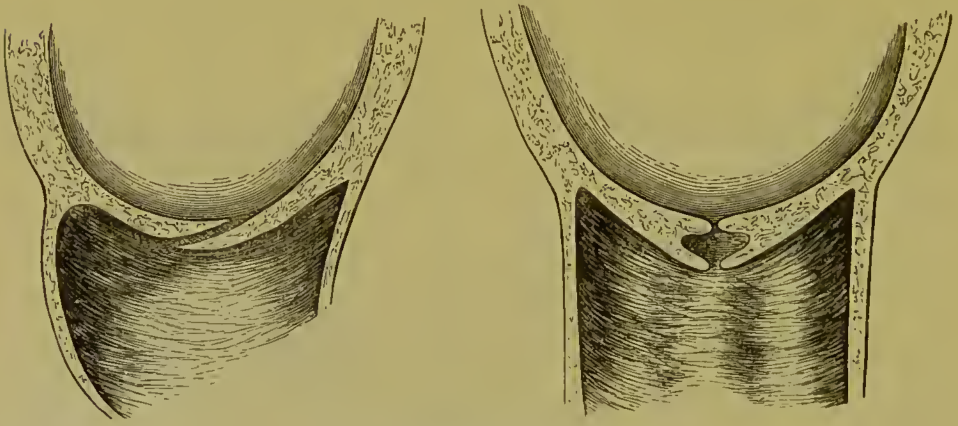


At Full Term.

strokes of the pencil, is at the present day a subject which still requires renewed and careful examination. In rejecting, as we may safely do, the theory of Désormeaux as applicable to all cases, it still remains for consideration whether it is applicable to any case whatever.

In so far as primiparæ are concerned, the views of Schultze seem to confirm those of Désormeaux, except that the latter believed the invasion of the cavity of the cervix to date from a still earlier period. In Figs. 96, 97, and 98, the conditions indicating the primiparous os are clearly indicated; but, as regards the period at which the resistance of the os internum is first overcome, the researches of Stoltz, and the more recent observations of Matthews Duncan, not only throw doubt on the views formerly entertained, but go a long way to disprove them. Indeed, the belief is now steadily gaining ground that, even in primiparæ, it is only during the last fortnight that the encroachment upon the canal of the cervix takes place,—Duncan, indeed, believing that its dilatation is only effected by the painless uterine contractions of the last few days of pregnancy.

Fig. 102. Fig. 103.



Apparent Shortening of Cervical Canal.

Practical investigation of the matter is unfortunately beset with no little difficulty, for not only are the opportunities of post-mortem examination few, but the circumstances are such, in most cases, as to render crucial observations in the living subject impossible without the risk of inducing premature labour. Our belief is that all cases do not follow the same law; but we have had no difficulty in convincing ourselves that, even in the last days of pregnancy, when the feel of the os externum and the apparent proximity of the presenting part would seem to imply that the entire canal of the cervix was lost, there often exists a canal, between the os externum and a point considerably higher, which passes obliquely through the uterine wall (Fig. 102). Stoltz and Cazeaux supposed that shortening of the canal of the cervix takes place without any yielding of the os internum,—the os internum and the os externum being approximated in consequence of the softening of the tissues above referred to. In other words, they supposed that the width of the cervix was increased at the expense of its length, and that, therefore, the shortening of the canal of the cervix in primiparæ was as is represented in Fig. 103.

As regards the process in pluriparæ (Figs. 99, 100, and 101) there is less difference of opinion, and we find that the ideas entertained by Schultze, and represented in the diagram referred to, differ very little from those promulgated by Stoltz and Cazeaux, and corroborated by the more extreme views of Matthews Duncan. The softening process attacks the tissue of the cervix in a manner precisely similar to that which obtains in the case of primiparæ. There is in this case, however, a gaping external orifice, which admits easily, even earlier than the twenty-fourth week, the point of the finger. From this period onwards, till about the thirty-sixth week, the only change which takes place is, that the cavity of the cervix becomes more and more accessible to the finger, which slips into it, as Cazeaux says, as into a thimble. The mechanical effect of previous pregnancy seems to be that the cavity proper admits of easy and ample distension, so that no call is made upon the cavity of the cervix until the termination of pregnancy approaches. Even in those instances in which the cavity of the cervix is most easily permeable by the examining finger, the os internum is, in pluriparæ, often found quite impassable at the thirty-seventh week, or even later. From this period, however, a very rapid shortening of the cervix takes place until, at the fortieth week, as in primiparæ, the cervix is in a manner effaced. But there remains to the last, instead of the thin, smooth, and almost membranous margin of the os in primiparæ, an irregular œdematous lip which is in the highest degree characteristic, and which is not wholly lost even during the first stage of labour. In the diagrams (Figs. 99, 100, and 101),—which may be compared with the adjoining figures,—the distinguishing features of the pluriparous os, as observed from the vagina, are represented.

Pluriparous Os.—Rapid as is the process by which the uterus is reduced in size after delivery, it never completely regains its virgin state. The os and cervix are the parts which show most distinctly the peculiarities which attach to those who have already borne children; and in the course of a digital examination, this peculiar feature comes prominently under our notice. This method of examination, therefore, enables us not only to recognise the stage of the pregnancy, but also to distinguish between first and subsequent pregnancies—due regard being had to the manner in which the cervix is developed in the two classes of cases.

The situation of the os uteri, relatively to the walls of the pelvis, is another point which is disclosed in the course of a vaginal examination. This is, however, of more importance in conveying information as to the stage of pregnancy than in regard to the fact of its existence; but as it may, under certain circumstances, become an important point in evidence, its omission here would be improper. We have already seen that, in consequence of the growth downwards of the uterus, the os is, in the first instance, displaced in the same direction, and, as we believe, somewhat backwards, this movement corresponding to the slight anteflexion to which reference has already been made. The escape of the uterus from the true pelvis, and the subsequent and rapid upward development of its body, soon cause a corresponding movement upwards of the os, which thus seems to follow the fundus, in proportion to its development, steadily upwards in the pelvis from the tenth to the thirty-seventh week, when it attains the highest point, and is reached by the finger sometimes with a little difficulty. With the descent of the uterus in the last weeks, it again sinks downwards, and, at the same time, moves backwards; so that, though lower, it is not more within reach of the finger. This final movement corresponds to the falling downwards and forwards of the fundus, mention of which has already been made. Sometimes the head descends to an unusual degree in the pelvis, and, in such cases, may push before it the anterior segment of the uterus. From this cause a difficulty occasionally arises, which may even give rise to the suspicion of atresia; but a careful examination by the finger, in the direction of the hollow of the sacrum, will rarely fail to disclose the position of the os—the difficulty being, of course, greater in first than in subsequent pregnancies, owing to the membranous thinness which the lips of the womb usually, in these cases, assume.

The "Toucher."—In the practice of the digital examination of the vagina, skill and experience are of paramount importance; and as it is by practice alone that the required dexterity can be attained, it behoves the student to avail himself of every opportunity which may arise for adding to his store of experience. With this view, some uniform scheme or method of examination should be adopted. A long finger is doubtless an advantage, but the advantage is by some writers greatly exaggerated. The index finger may alone be used, but some prefer to use two, by which we no doubt gain something from the greater length of the second finger. This advantage, however, is frequently counterbalanced by the increased pain which the examination gives the woman, causing her to shrink and draw away from the hand of the accoucheur. The finger should be passed forward from the situation of the coccyx over the anus and the posterior commissure of the vagina. It may seem almost too ridiculous to suppose that the anus should in such an examination be mistaken for the vagina, but the knowledge of the fact that the mistake has been committed will suffice to prevent the student from a similar error. The finger should be smeared with lard, vaseline, or soap and water, with the object in all cases, of facilitating introduction, and in a certain class of cases to protect the finger. Notice is to be taken, as a matter of routine, of the state of the perineum, labia, and other parts. The condition of the vagina and rectum, and of the pelvic walls, must, in like manner, not be overlooked, for, in all questions bearing upon pregnancy, the state of these parts must have a special interest, and the timely recognition of anything abnormal may have the effect of averting a calamitous result. In the actual examination of the os and cervix, some assistance will occasionally be derived from the use of the hand over the surface of the abdomen, by which the fundus may be steadied and the os pressed downwards more within the reach of the finger. In conducting such investigations as we have been referring to, the strictest caution must in every instance be exercised in order to obviate the possibility, which exists in every case, of premature labour being induced by rude and careless hands. The amount of irritation necessary to excite the uterus to contraction varies greatly in different cases, but we cannot doubt that incautious interference, more especially with the os and cervix, may incite contraction, and cause the loss of the product of conception.

Anal Examination.—In the investigation of uterine diseases unconnected with pregnancy, it is often proper to institute an examination *per anum.* In the practice of midwifery, and the diagnosis of pregnancy, such a mode of examination is very seldom necessary. Cases, however, do now and again occur, in which, owing, it may be, to excessive tenderness of the parts, or to partial obliteration of the vagina, the result of sloughing, we may be obliged to have recourse to this expedient. Or, again, it may be necessary for the proper examination of tumours, which exist as complications of pregnancy, and which are connected with the posterior part of the pelvis. And, in one other group of cases, we are recommended by Montgomery to examine thus, "when, for any particular reason, it is thought desirable to ascertain whether the uterus is enlarged within the first two months of supposed pregnancy." Under any circumstances, however, this mode of examination is so repulsive to the woman that, with that consideration for her feelings which should always sway us, we instinctively shrink from proposing it, unless the circumstances be such as to render it absolutely essential.

Quickening.—The period of Quickening is that at which the mother becomes for the first time conscious of the movements of the fœtus within her womb. They who at one time believed that the ascent of the uterus from the pelvis to the abdominal cavity took place suddenly, and was not a simple process of gradual evolution, held, naturally enough, the view that the quickening was this assumed sudden motion. Every woman now knows that it is due to the actual movements of the living child, which are at this period first communicated to her senses. The sensation, however, does not represent the first movements of the child, for they are seldom perceived by the mother earlier than the sixteenth week, whereas, in abortions at a much earlier period, vigorous movements are often observed after the expulsion of the embryo. Nor is it an uncommon thing, in the course of an abdominal examination by the hands or the stethoscope, to feel or to hear slight movements which we can only suppose to be exercised by the fœtus, and that too at a time when the mother may still be in doubt as to the fact of her pregnancy.[1] The time usually stated as that of quickening is about the middle of pregnancy, or four and a half calendar months. This belief, although only a popular one, is sufficiently wide of the truth to call for correction, seeing that, in most cases, the seventeenth week may be assumed as the average period at which women feel the first feeble flutterings which to them indicate the vitality of their offspring. In some instances, the movement is more decided, even at this time, but the rule is that it is at first very faint, and gradually becomes stronger in proportion as the development of the fœtus progresses. In the latter months, the fœtal movements become so vigorous, that they may cause the woman actual pain, and have been known to cause her to cry out.

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[1] It is generally believed that the mother cannot be conscious of the fœtal movements until the uterus comes in contact with the abdominal walls. It is then for the first time possible that the sensation can be transmitted by sensory fibres of the cerebro-spinal system ramifying in the abdominal parietes. This theory accounts, as it appears to us, quite satisfactorily, for the phenomena which exist; for we cannot doubt that the limbs of the child must strike the uterine walls at an earlier period than they are perceived by the mother, and it is not to be expected that the sensation could be communicated through the few filaments which reach the uterus from the cerebro-spinal system, as these are confined to the os and cervix.

At this stage of pregnancy, the movements which are perceived are due to brisk flexion and extension of the joints of the lower limbs, the sensation being in some instances due to smart kicks, and in others to a continuous movement, such as might be caused by the passage of the knee along the inner uterine wall. Important as this sign is to the accoucheur, and all-important as it is to the woman, it is nevertheless one in regard to which we must always be cautious, as there are fallacies which may lead astray even those women who have previously borne children, and who may thus be supposed to be familiar with the sensation in question. The conditions which may give rise to such erroneous impressions are rapid movements of gas in the intestines, irregular contraction of the muscles of the bowels, or even of the muscles which form part of the abdominal walls; and the pulsatile movements of an aneurism, or of a large artery, which, being communicated to a tumour within the abdomen, may very readily deceive a woman who already suspects that she is pregnant. Such cases are so frequent, that we must always be careful in receiving as evidence the mere statement of the woman.

Movements Felt or Seen.—We have hitherto spoken only of the active movements of the fœtus, as observed by the mother. But these movements receive, as evidence of pregnancy, a vastly increased significance, if, in addition, the accoucheur is able to convince himself of their reality, which he generally can succeed in doing by careful abdominal palpation. The nature of the tumour, its symmetry, and its elasticity, will already have prepared him for the corroborative evidence which he expects, and a very ordinary skill will prevent him from being misled by any disturbing influences, such as may deceive the woman. He is conscious of the presence under his hand of a solid body, contained within an elastic tumour. He presses this body from side to side, and in various other directions, with the almost certain effect, if the child be alive, of causing such movements as, from the fifth month onwards, will place the question of pregnancy beyond the possibility of doubt. His eye, meanwhile, may follow many of the more violent of these movements, the abdominal wall forming from time to time distinct projections, corresponding to the subjacent portion of the limb or body of the fœtus, so that the outline of the abdomen is for the moment distorted, the projecting part often suddenly changing its site before it sinks down again within the liquor amnii. But even here we are not safe from error, as, in some instances, movements closely resembling those of pregnancy have been observed by the accoucheur. The only condition, however, which might mislead any one using ordinary care, is that which arises from spasmodic action of the abdominal muscles.

An interesting example of this occurred many years ago in the Glasgow Royal Infirmary, in one of the wards at that time under the care of the writer. This woman was thirty-two years of age. She had been married for several years, but had had no children. She had been admitted on account of bronchitis, and was highly hysterical. She stated that she was pregnant, an assertion which at first attracted little attention, but as she stated subsequently that she had been pregnant for fourteen months, the case was looked upon with some interest by the students attending the clinique. The symptom upon which she founded her belief was the motion of the child, which she said she felt frequently and quite strongly. On examination, a tumour was observed in the abdomen, somewhat to the left of the middle line, reaching as high as the umbilicus, and not at all unlike the gravid uterus at the sixth month. When the hand was placed over this and held steadily for a little, distinct jerking movements were noticed, which, for the moment, seemed to have some resemblance to such as might be caused by a fœtus in utero. A little further examination soon showed the true nature of the case: the tumour was tympanitic on percussion, and nothing like the outline of the uterus could be felt; the os, on vaginal examination, was found to have none of the characteristics of pregnancy; the stethoscope gave a negative result. And to make things certain, the woman was put under the influence of chloroform, when the tumour completely disappeared, and the suspicious movements ceased. The case was one of "phantom tumour," with spasmodic contraction of the abdominal muscles; but no amount of reasoning could shake the patient's belief in her pregnancy, and she left the hospital in the full conviction that she was sixteen months gone with child, and that in the course of the succeeding month she would give birth to a child in an unprecedented condition as to development.

Ballottement.—An important sign of pregnancy is also to be found, under certain special conditions, in the Passive Movements which may be imparted to the fœtus. This sign has been called by some English writers "Repercussion," but is more familiarly known under its French designation, which is certainly the more appropriate of the two. The following is the manner in which this test is usually applied:—The woman is placed in a position which is intermediate between reclining and standing, and a very convenient plan is to have her shoulders supported behind, while she sits on the edge of the bed, with her feet upon the ground. The fundus uteri is then steadied by one hand, while the index finger of the other is introduced in the usual way into the vagina, with the palmar surface upwards. The finger thus placed is then brought into contact with the anterior segment of the uterus, near the cervix, where the presenting head of the child will generally be most easily felt. A smart jerk is given upwards, and the finger then kept perfectly steady, in its original situation, when, if the attempt be successful, it will be found that the fœtus, which had risen up in the liquor amnii, in obedience to the impetus which had been given to it, falls, in a few seconds, back into its original place, and seems to poise itself upon the tip of the finger, communicating to it the peculiar sensation from which the test derives its name.

Although the posture above indicated is that in which the sign of ballottement is most readily recognised, it is by no means the only position in which it may be made out. A precisely similar sensation, indeed, is communicated when the woman lies upon her back, or even (although more rarely) when she occupies the ordinary obstetrical position on the left side. The same effect may also be produced in the course of abdominal palpation, in a case of advanced pregnancy, when, if the woman is placed upon her side, in the horizontal position, and one hand passed beneath the projection, there will be felt, if the abdominal walls are not too thick, some portion of the body of the fœtus resting upon the hand. This, not unfrequently, may be displaced, and will return upon the fingers precisely in the same manner, and on the same principle, as when the examination is conducted in the usual way.

The sign of ballottement establishes the presence, in a fluid medium, of a solid body. This body must obviously be, on the one hand, of sufficient size to be perceptible to the sense of touch, and on the other, of a size considerably less than the cavity which contains it. It is clear that, unless these conditions are fulfilled, the sign is not available for the purposes of diagnosis. Of this proposition it is an obvious corollary, that it is only during a certain period of a pregnancy that ballottement can be distinguished. Before the fourth month, the size of the embryo is so small that it is impossible to produce the movement; but from this epoch till about the seventh month, it becomes more and more distinct. For a few weeks after this it may still be observed, although with greater difficulty; but, during the last six weeks, this method of examination gives no result whatever, in consequence of the great size of the child, and the extent to which the uterine cavity is filled by it. For a similar reason, it is not available in twin pregnancy. The only exceptions to this rule are cases in which the quantity of liquor amnii is greater than usual. Ballottement, in the hands of an experienced practitioner, may be looked upon as a certain proof of pregnancy; but by the inexperienced it is never to be relied upon, without strong corroborative evidence of some kind. The conditions requisite for its production are all fulfilled, it must be remembered, in the case of calculus in the bladder, when the solid body may be displaced with ease in its fluid medium. Anteversion of the womb, too, has, on a hurried examination, given rise to sensations closely resembling those of ballottement. In admitting, therefore, that ballottement is a certain sign of pregnancy, we do so, we repeat, with the reservation that it is so in experienced hands alone. *It is of special value when, the child being dead, the more certain signs are absent.*

Fœtal Pulsation.—By far the most important of all the signs of pregnancy, is that which is associated with the name of Mayor of Geneva, who was the first to discover that the heart of the fœtus could be heard beating through the abdominal and uterine walls. This discovery was announced in 1818, but attracted little notice until several years later. The period at which these sounds become audible in the course of pregnancy, is subject to considerable variation. It is certain that, as a general rule, it is not till the fifth month that they can be detected; but many trustworthy observers have asserted that they have heard them in the course of the fourth month, and even as early, in some few cases, as the eleventh week. This latter statement is generally looked upon with incredulity: There can be no doubt, however, that occasionally the sounds may be heard in the fourth, third, second, or even in the first week of the fourth month. On an average of a large number of cases, the eighteenth week may be stated as about the period at which we may expect to hear them.

The cardiac pulsations are much more rapid than those of the mother, and are, like them, double, although indistinctly so. They, of course, lack the volume of the maternal sounds, and are further enfeebled by the distance from the ear, and by the nature of the intervening media. The frequency of the beats is increased by the fœtal movements, and may thus be found to vary at different times, but it generally ranges from 130 to 160 in a minute. Some interesting observations made by Steinbach and Frankenhäuser seem to show that the heart's action is more rapid in females, by about fourteen beats in the minute, on an average of the two sets of observations. The pulse of the mother has no marked influence upon that of the child. It is scarcely possible, therefore, for any one who takes note of this frequency in the beats, to mistake them for maternal pulsations, which might, of course, under various anatomical and pathological conditions, be produced in any tumour under examination. The only case in which the possibility of difficulty can be admitted is where the maternal pulse is unduly accelerated by the existence of fever, or by some more transient cause; so that, in practice, it is well to adopt the simple precaution of placing the finger upon the mother's wrist at the moment we are making the stethoscopic examination, when, if there is obvious dichronism, we are sure of our diagnosis; while, on the contrary, if there is an approach to synchronism in the two pulses, caution is clearly indicated.

The pulsation of the fœtal heart is never heard over the whole surface of the abdomen, but, on the contrary, over an area which is always limited. This site varies with the presentation and position of the child, and it is often only after prolonged exploration that a point is discovered where the sounds are clearly audible; and, as we have already shown that the presentation of the child is more constant the nearer it is to the end of pregnancy, it follows that the earlier the period at which the examination is conducted, the greater will be the variety in the site at which auscultation has a successful result. It is usual, with a view of saving time and trouble, to adopt a uniform plan in conducting this investigation, beginning always at the point at which the sound, for well known reasons, is most frequently to be distinguished. The child lies, in the last months of pregnancy, in a large majority of cases, with the head downwards, and the back forwards and to the left, some portion of the back part of the trunk being thus brought into contact, almost invariably, with the uterine wall, somewhat to the *left* of the middle line. If—the fœtus being in this position—we place the stethoscope over any portion of the uterus other than this, the amnionic fluid which may lie between our ear and the heart of the fœtus cuts off all acoustic communication; or, even if we place it where there is a continuity of solid tissue, it is too far distant from the heart for the sound to be conveyed to the ear. The extent of the area over which the sounds are heard depends, in a great measure, on the quantity of the liquor amnii, being greatest when it is scanty, while, with much liquid, a small portion only of the fœtal trunk comes into contact with the uterine wall, and the area is thus proportionally small. The point, therefore, at which we have the best chance of at once catching the sound, is about midway between the umbilicus and the symphysis pubis, and somewhat to the left side. If the child is in what will be described afterwards as the second cranial position, the back being thus forwards and to the right, we may expect to hear the sound at a corresponding point to the *right* of the middle line. In the ordinary breech presentation the sound is heard as high as the level of the umbilicus, or even a little higher. In dorso-posterior positions, whether of the head or of the breech, the convexity of the spinal column being turned backwards sometimes constitutes a difficulty in auscultation, as is also created by an unusual quantity of the liquor amnii (Dropsy of the amnion), and by various abnormal presentations of the child. If, however, an examination conducted with due care at any time after the fifth month, and in the course of which the whole of the abdominal surface has been carefully explored, fails to detect the fœtal pulse, this, of itself, is very strong evidence, either that pregnancy does not exist, or, if it exists, that the fœtus is dead.

Auscultation in Twin Pregnancy.—It is generally believed to be possible to determine, by means of stethoscopic examination, the existence of a twin pregnancy by the following peculiarities: that, in twin pregnancies, the two hearts are heard beating at opposite points of the abdomen, and that they are frequently not synchronous in their action. If the latter point can be conclusively established by the simultaneous examination of two observers, the case is clear; but, in regard to the mere existence of pulsation at two opposite points of the abdomen, this cannot be admitted as satisfactory proof. It has, by some, been asserted that the distinction is easy, and that, when we have pulsation at two points, in a single pregnancy, the sounds reach their greatest intensity midway between the two; whereas, in a twin pregnancy, examination in the intermediate area gives a negative result. This, if true, would be a sure and easy test; but we are perfectly certain it is not to be relied upon, although it may represent the general rule. Still, taken along with the shape of the abdomen, and the results of careful palpation, pulsation at two points is an important symptom in the diagnosis of twins, which are generally placed to the right and left in the womb.

Funic Souffle.—Dr. E. Kennedy described another stethoscopic sound, which is synchronous with the fœtal heart. "In some cases," says he, "where the uterus and the parietes of the abdomen were extremely thin, I have been able to distinguish the funis to the touch externally, and felt it rolling distinctly under my finger, and then, on applying the stethoscope, its pulsations have been discoverable, remarkably strong; and on making pressure with the finger for a moment on that part of the funis which passed towards the umbilicus of the child, I have been able to render the pulsations less and less distinct, and even, on making the pressure sufficiently strong, to stop it altogether." This assertion of Dr. Kennedy's has been vigorously controverted in Germany; but even admitting the description to be absolutely correct, the observation is one, as has been well observed by Dr. Tyler Smith, "which can hardly be of practical use, because, when the abdominal and uterine walls are so thin as to permit us to feel the pulsation of the funis through them, the other auscultatory signs of pregnancy, and the evidence obtained by palpation, must already have set the question at rest; and, except under such circumstances, it must be very difficult to discover the funicular souffle."

Uterine Souffle.—The "bruit de soufflet," "placental souffle," and "Uterine Souffle," are among the most familiar of the designations which have been applied to another and an important auscultatory sign, which was originally discovered, in 1823, by M. de Kergaradec, but for whom, also, the more important observation of M. Mayor would have been overlooked. The various names by which the souffle is described point pretty clearly to the well-known fact, that speculations as to its nature and its cause have given rise to various theories, which display the existence of very contradictory opinions. All agree that the sound is maternal, not fœtal, as its rhythm corresponds to that of the maternal heart. The universal acceptation of the term "souffle" shows that, in regard to the nature of the sound, observers are at one. But, in so far as its seat and mode of production are concerned, great divergence of opinion has existed.

The Uterine Souffle, as, for reasons to be stated presently, and following Dubois, we prefer to call it, is distinguished at an earlier period than the fœtal pulsation. Dr. Kennedy, who has given much attention to this, as to the other signs of pregnancy, maintains that he has heard it as early as the tenth week; but usually it is not till the sixteenth week, or even later,—or, in other words, until the uterus is accessible to the stethoscope,—that it can be made out. These remarks apply to examination through the abdominal walls; for, if the metroscope of M. Nauche be used, it is possible that it may be heard at a somewhat earlier period. An occasional characteristic of the sound is that it is not constant. It may be distinctly audible at one moment, and may disappear the next, to return again in a short time,—these changes taking place without any appreciable cause. In some cases, it is heard over the whole abdomen; while, in others, it is confined within a limited boundary, usually in the region of the groins. Generally it is heard, in advanced pregnancy, over the whole of the lower part of the uterus but not over the fundus, nor in the lumbar region; but, in the earlier months, it may be heard over the symphysis, or wherever the uterus is accessible to the stethoscope. In regard to tone and pitch, the varieties are endless—presenting, in fact, from the soft whiff to the musical cooing or rasping sound, all the peculiarities of aneurismal or cardiac murmurs; and what is not a little remarkable, it varies in this respect, not only in different individuals, but in the same individual at different times.

If the observation be made during a labour pain, a very striking effect is often found to be produced by the contraction of the uterine fibres, the sound becoming, in the first instance, louder, more sibilant, or even musical, and then, at the height of the pain, becoming lost—to return, as it passes off, in the inverted order of the tones, as the pressure on the vessels is relaxed. It seems to have no fixed relation to the site of the placenta, and it certainly gives no reliable evidence, as might, perhaps, have been expected, as to where the placenta is situated in the uterus. The uterine souffle as a sign of pregnancy, is, no doubt, valuable, and is to be distinguished from any other arterial sound by the absence of impulse, and its persistence in every posture; but it must, on no account, be admitted as a certain sign. For, the attention which has of late years been given to the diagnosis of ovarian tumours has shown that one of the more constant signs of a pathological uterine tumour, and one which goes far to distinguish it from a similar structure originating in the ovary, is the existence of a souffle, having the closest possible resemblance to that of the pregnant womb. Under no circumstances is the uterine souffle to be held as proof of the life of the child.

Theories as to Cause of Souffle.—A certain number of observers were long of opinion that the sound which we are now considering was caused by pressure on the great arterial trunks which lie in the posterior part of the pelvis. This must at once be admitted as a possible cause of such a sound, seeing that pressure on arterial trunks of sufficient caliber may, in any situation, produce a souffle. But that this is not the case in pregnancy, seems to be proved by the fact that such a change of posture (the prone position, for example), as would remove the uterus for the time being from the neighbourhood of the vessels, never has the slightest effect in arresting the souffle. The view which was entertained by M. Kergaradec himself in regard to the production of the sound, was that it is produced in the utero-placental vessels, and on this account he named it the "bruit placentaire." It is of course quite possible that the passage of blood through those vessels may contribute to the sound; but the fact that the sound may be heard after the birth of the child, and even after the expulsion of the placenta, seems conclusively to prove that the cause does not reside, as he supposed, solely in the vessels in question. The presumption, on the contrary, is strong that its site is elsewhere.

The theory which owes its origin to Dubois is as follows. This distinguished accoucheur assumed that the blood, in passing from the uterine arteries to the uterine veins or sinuses, presented characters precisely analogous to those which constitute aneurismal varix, or which produce the souffle in erectile tissues. In all of these cases, as he observes, we have arterial branches discharging their blood directly into veins, the more rapid current joining a more sluggish one; and this, he adds, "is undoubtedly the cause of the murmur and the bruit de soufflet which is so remarkable in aneurismal varix and erectile tissues." His conclusion is that, very probably, the same causes within the uterine walls produce the same results. A theory somewhat similar to that of Dubois was advanced by Corrigan, with the additional suggestion that the sounds are modified by pressure of the fœtus against the uterine walls. De la Harpe believed that the sound was due simply to the multiplicity of currents of blood within the uterine walls: the sound from each vessel being, by itself, inaudible, but the aggregation of many giving rise to the familiar sound. Finally, there is the view of Scanzoni, who holds that the blood during pregnancy is in a chlorotic state, and that the sound is due mainly to causes which have their seat in the composition of the blood, and are accompanied by murmurs analogous to those with which we are familiar in the case of chlorotic women. The ingenious theory of Dubois may, no doubt, in some particulars, be inaccurate; but the opinion now generally entertained of the cause of the bruit is—that it has its origin in the uterine walls, and neither in the vessels external to them, nor in the placenta within them, and that, therefore, the views of Dubois and Corrigan are, in all probability, very near the truth.

Auscultation of Fœtal Movements.—As has already been observed, the movements of the fœtus may occasionally be observed, by means of the stethoscope, at a very early period. This mode of investigation, which we owe to the younger Naegele, is one which is surrounded by so many difficulties and sources of fallacy that, important as it seems to be, it is never likely to be of any great practical worth. The possibility, however, which is undoubted, of thus recognising fœtal movements at a time when the other evidence must be very inconclusive, is a point not to be lost sight of. Possibly this, as well as the other stethoscopic sounds, might be early recognised by the use of the Metroscope, a modification of the stethoscope, which was devised by Nauche with the view of directly auscultating the uterus from the vagina, but which has fallen into disuse.

Certain Signs.—The signs of pregnancy consist, then, of a few which are Certain, and of a considerable number which are Probable or Presumptive. The certain signs are—

1. The Sounds produced by the Pulsations of the Fœtal Heart.
2. The Active Movements of the child, distinctly felt by *a skilled person.*
3. The Passive Movements, which constitute the sign of Ballottement.

If any one of these signs is made out, the woman is incontestably pregnant. But, in regard to the negative evidence which is afforded by their absence, this can only be admitted as proof that the woman is not pregnant when the other signs are awanting: the absence of one is only

TABLE, SHOWING THE SIGNS OF PREGNANCY AT VARIOUS EPOCHS.

Weeks.	Disturbances and Alteration of Function.	Position and Anatomical Relations of the Uterus.	Condition of the Os and Cervix. 1. In Primiparæ; 2. In Pluriparæ.	Special Characteristics of the various Epochs.
1st to 8th.	Suppression of Menses (occasional exceptions). Swelling and pain in Breasts. Morning sickness, and other digestive derangements.	Volume and weight increased: Lower in pelvis: Os displaced downwards. Very slight hypogastric flattening and depression of Umbilicus. Fundus still below the level of the pelvic brim.	Investing mucous membrane becomes thick and softened. Os in Primiparæ becomes round; in Pluriparæ it is more open, and admits the point of the finger.	Turgescence and increased temperature of external genitals, and of Vagina, the mucous membrane of which becomes darker.
9th to 16th.	Marked enlargement of Breasts, with prominence of nipple, and slight deepening in colour of the Areola.	Fundus passes brim about 12th week, and is midway between pubes and umbilicus at end of 16th. It is distinguished by palpation and percussion. Less depression of Umbilicus: hypogastric flattening disappears. Os reached with more difficulty, and is situated somewhat to the left.	Softening extends gradually from mucous membrane to tissue surrounding os. Orifice closed in Primiparæ; in Pluriparæ still more open.	Uterine souffle about 16th week.
17th to 24th.	Areola becomes distinct, the Follicles projecting beyond the level of the skin. Morning sickness, and other digestive disturbances less. Certain effects of mechanical compression now often observed, such as varicose veins, and œdema of the genitals.	Fundus gradually rises; is a little beneath the umbilicus at the 20th, and a little above it at the 24th week. Rounded central tumour in hypogaster, becoming gradually more apparent. Umbilical depression almost effaced. Os and Cervix still higher.	Softening further invades the cervix. In Primiparæ, os circular, smooth, and closed. In Pluriparæ, irregular, nodulated, and usually admitting, without difficulty, the point of the finger.	Projections of fœtus may be felt. Active movements may be experienced by mother about the 17th week, and felt by the accoucheur some weeks later. Pulsation of fœtal heart about 18th week. If the head presents, Ballottement can be made out about the 18th week. Dark lines on abdomen; and secondary areola may also be observed.

25th to 32nd.	Deeper colour of the Areola, with complete development of the glandular Follicles. Morning sickness rare. Effects of mechanical compression more marked. Vagina often granular, with leucorrhœal discharge.	Fundus at 28th week about two inches, and at 32nd three inches above umbilicus. Uterine tumour larger, and directed to the right side. Umbilical depression completely effaced. Os and Cervix still ascending, and directed backwards, and a little to the left.	Softening of Cervix complete. In Primiparæ, the os internum is supposed by some to yield from the 24th week, and the cavity of the cervix to become encroached upon from above downwards. In Pluriparæ, os internum remains closed, but the cavity of the cervix admits the finger with ease.	All the above conditions become more intensified and obvious.
33rd to 38th.	Disorders of Digestion and Respiration, the result of pressure by the distended uterus.	Fundus rises as high as the ensiform cartilage, and on each side is behind the false ribs. Umbilicus inverted, and protruding. Os reaches its highest point. Inferior segment of uterus becomes thinner, so that the presenting part of the child can be more easily felt.	In Primiparæ, the cervical cavity is said to have lost half its length about 34th week. External os admits point of finger. In Pluriparæ, internal os only yields at 36th week, or even later, when the shortening of the cavity rapidly progresses. Lips of os thick and soft, and admitting the finger as far as the membranes.	As in the 7th and 8th month—with the exception of Ballottement, which is generally no longer available.
39th and 40th.	Functional disorders disappear. Œdema and varicose condition of genitals increased. Pain and difficulty in walking.	Fundus falls downwards and forwards, the Os moving at the same time downwards and backwards in the true pelvis. Prominence of umbilicus reaches its maximum. Presenting part often low in pelvis.	In Primiparæ, the cervix apparently disappears; the lips become very thin, and almost membranous. The os opens a little. In Pluriparæ, the lips remain irregular, and of considerable thickness to the last.	All the appearances due to stretching of the abdominal parietes become more distinct.

sufficient to warrant a doubt. To the three certain signs given above, Montgomery added a fourth—the secondary areola—but, as this is open to doubt, and is only to be observed in a limited number of cases, we include it among the probable signs.

It is quite unnecessary that the latter should be again enumerated. Singly they are of little value; but, when a considerable number of them are simultaneously observed, in cases where pregnancy is expected, as in married women, the evidence thus afforded is tacitly admitted as complete. For such a diagnosis, the medical attendant should not be held responsible; but if it turn out, after all, to be a mistake, he will find that, in accounting for the blunder, a large share of the blame will lie at his door. For a certain opinion, such as one would be warranted in giving upon oath in a Court of Justice, no combination of merely probable signs will suffice. In addition to these, however imposing their array, we must, in every case, have one at least of the certain signs, before we can, with all confidence, assert that a woman is pregnant.

If the child is dead, it is obvious that two out of the three signs are no longer available; but, in these cases, there may still be ballottement, or there may be present signs which are held to indicate the death of the fœtus, and which will be noticed in their proper place. The question may be put to us: Is pregnancy probable in this case? or, Can you say with perfect confidence that the woman is not pregnant? The reply to such questions must be given with the greatest caution, and will depend very much on the correct appreciation of the various probable signs, and the exact value which attaches to each, or to each group of such signs. In most cases of doubt, some period will be given as the probable or possible time from which, if existing, the pregnancy must date; and it will be upon a careful analysis of the signs proper to such period of pregnancy as may thus be indicated, that our opinion will, in the end, be formed. With a view of facilitating such an investigation, the preceding table has been drawn up, in which is given the average period at which the various signs are available.

CHAPTER X.

DURATION OF PREGNANCY : SUPERFŒTATION.

DURATION OF PREGNANCY : *Observations in Domestic Animals : in Women.—Protracted Pregnancy: Cases of.—Difference in Rate of Development.—Mode of calculating the probable Date of Delivery : Calculation from last Menstruation to be corrected by Period of Quickening.*—SUPERFŒTATION : *to be distinguished from Superfecundation.—Proofs of the latter.—Superfœtation in Extra-Uterine Pregnancy : in Double Uterus.—Twin Pregnancy in relation to this Subject.—Cases.—Conclusions.*

Duration of Pregnancy.—This is a subject, which, in so far as regards the human race, is enveloped in no little obscurity. Our chief difficulty arises from the fact, that it is only in a very small number of cases that the date of fertile coitus can be accurately ascertained; and, further, in the majority of these, it is probable that the data are open to doubt. For example, when an unmarried girl says she is pregnant from a single coitus, may we not suspect that she does so to palliate her fault, as she can no longer conceal her shame; and the more closely, indeed, we investigate this class of cases, the more convinced do we become that many so-called instances of pregnancy from a single act should not be admitted in evidence. The proof, however, which is afforded by undoubted cases of this nature, and that which is derived from other sources, is sufficient to show that there is a considerable difference in the duration of pregnancy, consistent with maturity of the fœtus and a normal state of the pregnancy from first to last.

Observations in Domestic Animals.—In the lower Mammalia one coitus, coinciding as it does, with the period of rut, is generally followed by conception. This admits of observations of an exact kind in the case of many of our domestic animals; by means of which, indeed, much of what is known in this domain of physiology has been, in a great measure, established. In 1819, M. Tessier submitted to the

Académie des Sciences at Paris the result of a series of investigations of this nature, which are of some interest as illustrating by the light of comparative physiology the question which we are now considering. The observations were, in fact, instituted with the object of determining the possibility of protracted gestation in the human race. The following are the leading results :—

OF 140 COWS :—

14	calved	between the	241st	and the	266th	day,
53	,,	,,	269th	,,	280th	,,
68	,,	,,	280th	,,	290th	,,
5	,,	,,	290th	,,	308th	,,

the extreme difference between the births, in an animal in which gestation is only a little more protracted than in women, being thus 67 days. An extended series of observations of a similar nature, and yielding similar results, was conducted by the late Lord Spencer :—

OF 102 MARES :—

3	foaled	on the	311th			day,
1	,,	,,	314th			,,
1	,,	,,	325th			,,
1	,,	,,	326th			,,
2	,,	,,	330th			,,
47	,,	between the	340th	and the	350th	day,
25	,,	,, ,,	356th	,,	360th	,,
21	,,	,, ,,	360th	,,	377th	,,
1	,,	on the	394th			day,

the extremes in this case embracing a period of no less than 83 days.

Of course, as regards the cases in which the birth took place much earlier than the ordinary period, it may be said that they were examples of premature delivery; but even if, by striking them off, we remove this possible fallacy, there still remains a sufficiency of facts to prove that, in those animals, there is considerable latitude as to the exact day at which labour may be anticipated. And, if this be the case in animals where sexual excitement is in abeyance during the whole period of gestation, is it not even more likely to obtain in the case of women, in whom sexual excitement persists, and who are exposed to moral and social influences, and to diseases, one and all of which may act as disturbing influences, and thus cause irregularities in the period of delivery? And, in point of fact, this has been shown to be the case, by numerous examples which have been carefully noted by experienced observers.

Calculation from last "Period."—The usual method of determining the approximate duration of pregnancy, it being impossible to fix the date of conception, is to make the calculation from the last day on which the menstrual discharge was observed. It was upon this principle, and selecting those cases only in which this starting-point could be exactly determined, that Dr. Merriman conducted his investigations, with the results which are quoted in almost every work on obstetrics. Of the 150 mature births observed by him—

5 were delivered in the 37th week—255 to 259 days,
16 ,, ,, 38th ,, —260 to 266 ,,
21 ,, ,, 39th ,, —267 to 273 ,,
46 ,, ,, 40th ,, —274 to 280 ,,
28 ,, ,, 41st ,, —281 to 287 ,,
18 ,, ,, 42nd ,, —288 to 294 ,,
11 ,, ,, 43rd ,, —295 to 301 ,,
5 ,, ,, 44th, the latest being the 306th day.

In this most interesting and reliable table a difference is shown between the extremes of 51 days. The following table, consisting of 500 cases, by Dr. James Reid, is of no less interest, and is calculated like that of Merriman from the last day of menstruation.

Of the 500 cases

23 were delivered in the 37th week—255 to 259 days,
48 ,, ,, 38th ,, —260 to 266 ,,
81 ,, ,, 39th ,, —267 to 273 ,,
131 ,, ,, 40th ,, —274 to 280 ,,
112 ,, ,, 41st ,, —281 to 287 ,,
63 ,, ,, 42nd ,, —288 to 294 ,,
28 ,, ,, 43rd ,, —295 to 301 ,,
8 ,, ,, 44th ,, —302 to 308 ,,
6 ,, ,, 45th ,, —309 to 315 ,,

the difference between the extremes being in this case no less than 60 days.

The results yielded by these two tables prove that, calculating in this manner from the last day of the last menstruation, considerable variations in the duration of pregnancy seem to occur. But such seeming variations must be viewed with caution. Our calculation is not here, as in cows and mares, from the very day and hour of coition, but is made in full knowledge of the fact that conception may have occurred on any one day of a period extending over more than three weeks. Such conclusions as may be admitted, upon an analysis of the cases of single coitus in the human species which are on record, tend to show pretty clearly that, although the range is less than in the lower animals, there is an undoubted variation within certain limits.

Dr. Reid, in a series of papers from which the above table was taken, gives an analysis of 43 cases of single coitus which he had collected; but, as we entertain grave doubts of the accuracy of such tables, for reasons already stated, we refrain from quoting it *in extenso.* According to it, delivery took place in from 260 to 300 days, a range of no less than 40 days, and the average duration of gestation is shown to be about 275 days.

The facts above cited seemed to show that the question of the duration of pregnancy is one which is of the highest importance, not only in an obstetrical, but in a legal sense; and it is indeed upon the facts established by scientific and obstetrical research, and the opinions which are founded upon them, that the laws bearing upon the subject have been framed, and are interpreted in courts of law. One of the most interesting cases of this kind on record is the well known Gardner peerage case, of which the following is a brief outline:—

> "Lord Gardner parted from his wife on board of his ship on the 30th of January, 1802, and, having proceeded to the West Indies, did not see her again until the 11th of July following. Lady Gardner had been living in open adulterous intercourse with a Mr. Jadis, and on that account his Lordship obtained a divorce after his return, and subsequently contracted a second marriage. The case came before the House of Lords in 1825, when Allan Legge Gardner, the son of Lord Gardner, by his second wife, petitioned to have his name inscribed as a peer on the Parliament Roll. Another claimant, however, appeared in the person of Henry Fenton Jadis or Gardner, who alleged that he was the son of Lord Gardner, by his first, and subsequently divorced wife. He was proved to have been born on the 8th of December, 1802, and the question in view of the above facts simply was (as the possibility of the pregnancy dating from July was not put forward) whether a child born 311 days from possible intercourse, could have been the child of the deceased Lord Gardner. The medical evidence, as, unfortunately, it too often is in such cases, was very contradictory, but is particularly interesting as bringing out the opinions of the greatest obstetrical authorities of the day. Sir C. Clarke, Dr. Gooch, and Dr. Davis stated their belief that 40 weeks (280 days) is never exceeded, while, on the other hand, Drs. Blundell, Conquest, and Granville asserted that this period was in some cases undoubtedly exceeded, and to such an extent that they were warranted in admitting the possibility of the claimant, Henry Fenton Jadis, having been a ten and a half months' child. Their Lordships found that the elder claimant was illegitimate, and that, consequently, the son of the second marriage was Lord Gardner. It must be admitted, however, that the moral evidence in this case had probably more weight than the medical."

Since this decision, the attention of the profession has been much more carefully directed to the subject, and probably no one at the present day would venture to assert that 280 days is the *ultimum tempus pariendi* which some legal authorities supposed it to be. Were we able to date from the moment of conception, which under no circumstances is possible to us, we could soon collect sufficient data to guide us in future. But we must not forget that, even in those cases in which the calculation is made from a single coitus, the time of *insemination* does not necessarily mark the time of *fecundation*, and there is good reason to believe, from what has been observed in the lower animals, that some days may elapse before the fertilizing principle encounters the ovum. Then, again, if we date from menstruation, we must admit the possibility of irregular menstruation prior to impregnation, in which case conception may occur six weeks or more after the last menstruation. And if we admit this, as we tacitly do in cases of married women who seem to carry the child longer than usual, we are bound in common fairness to allow the same argument to those who wish to prove the possibility of protracted pregnancy. The following instance, from the writer's case book, will serve to illustrate this:—

> "Mrs. P., who before had borne one child, ceased to menstruate on the 11th of September. On the 23rd of December, she had slight hæmorrhage and other symptoms of threatened abortion. Nothing solid came away, and she was confined strictly to bed until all the symptoms had disappeared. Previous to this, she had had morning sickness. In the course of the month of February, she felt motion, but did not note the date. Development went on as usual, and she enjoyed excellent health.
>
> "On the 17th of July I visited her, being somewhat astonished at the duration of the pregnancy. On examination I felt the outline and feet of the child quite distinctly, the latter moving vigorously in the right hypochondriac region, where the movements had subjected the mother to much annoyance. The os uteri was patent, so as to admit the point of the finger, and was quite cushiony and soft. The cervix was short, but quite perceptible. The presenting part could not be reached by the finger. On the 22nd of July, 314 days from the last menstruation, a male child was born of average size and quite healthy."

In this case menstruation was habitually irregular, and there was often an interval of six weeks between the periods. If we assume therefore that impregnation occurred immediately before a menstrual period was due, that is, after an interval of six weeks (42 days), from her last menstruation, this would make the duration of pregnancy exactly 273 days.

The following case is of a somewhat similar nature, but is further interesting as affording an illustration of what we believe to be in many cases an essential element in determining the probable duration of pregnancy. The sensation of quickening is generally, as has been observed, perceived by the mother a little before the middle of pregnancy, and should always be accurately noted, if possible. Were this done in every case, it would serve to correct errors which may arise from calculations based exclusively on the last menstruation. Had it been done in the following instance, some trouble and anxiety might have been saved; and the same remark might possibly apply with equal force to many of the so-called examples of protracted gestation :—

"Mrs. M., who had previously borne eight children, ceased to menstruate on the 13th of September. For some months after this she suffered much from spasmodic asthma, which seemed to be associated with the pregnancy, of the existence of which she was for some time doubtful. The movements were said to be less vigorous on this than they had been on former occasions, but in all other respects she went on well, the asthma becoming progressively less as the pregnancy advanced. The calculated time having long passed, and a more careful questioning having been adopted, it was found that quickening dated *from the first week in March at soonest.* Only one menstruation had occurred since her former pregnancy.

"July 24th.—On examination, the os is found to be patent. A few pains have occurred Head easily reached and presenting.

"July 31st.—Child born at 5 A.M., 322 days from the last menstruation."

If impregnation had not occurred in this case, we may suppose it possible, if not probable, that the second menstrual period after the former confinement would have taken place between six and seven weeks after the first, and that impregnation had occurred immediately before this—say on the 24th of October, or 280 days before birth.

The last case which we shall cite in illustration of this subject is one of special interest, inasmuch as it is calculated from a single coitus under circumstances which leave no room for doubt as to the facts, and in which the pregnancy was unusually prolonged :—

The subject of the case in question, Mrs. R., had previously had seven children, one having been a transverse presentation, and several having been delivered with the forceps. Her general health being indifferent, she dreaded greatly another pregnancy, and on that account absented herself from her husband's bed. In the month of March the latter went on a visit to the country, where Mrs. R. visited him for a single night, circumstances having arisen which obliged her to go to the Continent, where she remained for two months. The date of this visit was the 2nd of April, and before her return home she was convinced by previous experience that she was pregnant. The date of the last menstruation was a little uncertain, but was about the 27th of March. To the astonishment of every one who knew the circumstances, the pregnancy continued far beyond the ordinary limits, until, on the 22nd of January, she was delivered of a very large male child weighing 12 lb. 3 oz., 295 days from what we believe to have been beyond all doubt a solitary coitus. An interesting point in the case was the great size of the child, indicating possibly that it had been retained within the womb beyond the ordinary period of maturity.

Many writers, among them Scanzoni, maintain, and some observations seem to confirm their view, that the rate of intra-uterine development is not always the same; and that children born mature at an earlier period than usual are to be described as exceptional (*Graviditas Præcox*), while the contrary class of cases are those in which, development being slow, maturity is not reached until a period considerably beyond the average (*Graviditas Serotina*).

The facts just stated furnish a general confirmation of the observations of those whose conclusions are embodied in the tables which we have given. The maximum, according to Reid, is 293 days, as deduced from his cases of single coitus; our own case above quoted is 295; and Merriman's maximum of 306 days from the last menstruation will, if calculated from the probable time of conception, give about the same result. In Scottish Law, and in the French Code, the period of 300 days is fixed as the utmost possible limit, and in Prussia 301, so that in these countries the child of a woman who is delivered 302 days after the death or proved absence of her husband is declared illegitimate. Difficult as it is, and always must be, to fix precisely the limit, we are inclined to think that these laws are just; for, while it is the object of the law, from one point of view, to protect the innocent offspring from the brand of illegitimacy, if it be possible to do so, it is in like manner the duty of those who administer the law, not rashly to confer the position and privileges of legitimacy upon the fruit of adulterous intercourse. In English Law, no period or limit is fixed, and cases, when they arise, fall to be decided in the light of the medical evidence of experts, and of the moral and collateral aspects of the case. In America, a more liberal view is taken, to judge from some legal decisions which are quoted by Taylor, where paternity was held to be proved in two cases, the duration of the pregnancy from coition being shown in one to be 313, and in the other 317 days. It is possible that the American views on this subject may have received their colour from the extreme views entertained by one of the most eminent obstetricians in that country, Dr. Meigs, of Philadelphia, who has expressed a belief that gestation might continue for a year, or even more.

With reference to what has been said as to the probability of 300 days being a liberal interpretation of a law of nature, it must not be forgotten that some very able obstetricians in this country have expressed a different opinion. The names of Simpson and Murphy are a sufficient guarantee that the cases cited by them, on which they found their opinion that pregnancy may be prolonged considerably beyond the period named above, are free from the suspicion of careless investigation; but, on the whole evidence before us, we conclude that the extreme cases must be disallowed, as the sources of fallacy are too numerous to warrant us, without clear evidence, in sanctioning the extension of the limit beyond 300 days.[1]

Probable Date of Delivery.—Speaking in general terms, pregnancy may be stated as lasting, under ordinary circumstances, for nine calendar months,—from 273 to 276 days, according to the length of the months which intervene. But, as we are ignorant of the date of conception, and can only make the above calculation under very exceptional circumstances, some other mode has to be adopted in practice. It is a matter of some importance to the practitioner, and one on which his comfort in no small measure depends, to be able to forecast his obstetrical engagements; and this subject is, on that account, to him one of special interest. A long series of careful examinations, conducted by independent observers, seems clearly to show that the period of impregnation is usually about a week after the cessation of a menstrual period. A ready method of reckoning, which is founded on this belief, is recommended by many German authors, and is very generally practised by nurses in this country. It consists in taking the date of the last menstruation, reckoning three months back, and adding seven days. For example, a woman has ceased to menstruate on the 8th of June; three months back (or nine months forwards), gives the 8th of March: to this add seven days = 15th of March, which will be found, in a large number of cases, to be within a few days of the actual time of delivery.

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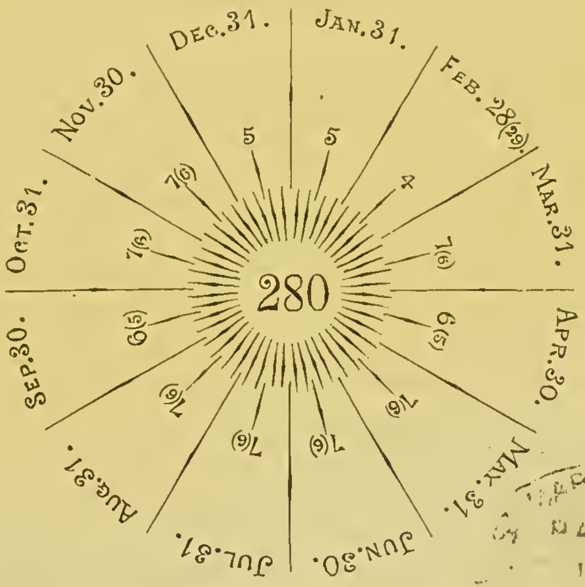
[1] Some reliable information, in regard to this subject, has been derived from the observation of pregnancy in Jewish women. The author is mainly indebted to a very able physician and accoucheur of that persuasion for the following information. Among Jews, the sexes are separate during menstruation, and for seven clear days thereafter. The shortest period allowed for menstruation is five days, even should it last only for an hour or two, so that the *minimum* period of separation every month is twelve days: and, in anything approaching menorrhagia, of course much longer. This law is observed by the vast bulk of the Jewish women; the exceptions are very few. After the period of separation, whatever that may be, the woman, besides an ordinary bath for cleansing purposes, must take what is called the "bath of purification." She simply dips in this but does not wash. This gives a fixed day, from which a Jewish woman reckons, as she knows the day she went to *the* bath, and calculates accordingly. Any one who may have an opportunity of making observations in this direction, will find, 1st, that Jewish women calculate more accurately as to the duration of pregnancy; 2nd, that, according to their experience, the duration of pregnancy seems to be rather less than is usually supposed; and 3rd (although this has less to do with the subject more immediately under consideration), that, as has been observed by a late writer in Germany, this frequent and protracted abstention from sexual intercourse may be admitted as a possible cause of the undoubted vitality of the Jewish race.

For greater exactness, as well as for the purposes of general scientific accuracy, it is better to make the calculation in such a manner as may enable us to compare one case with another, and at the same time reduce possible error to a minimum. This is done by calculating in each case 280 days, or ten lunar months, from the last menstruation, which is equivalent (by deducting seven days) to nine calendar months from the assumed date of conception. This calculation, simple as it is, implies a certain amount of trouble, to reduce which various tables have been constructed. Such tables, however, as are given by Naegele, or by Murphy, after Dr. Ryan, are too elaborate to be of any real practical every-day use, and to read them requires almost as much trouble as to make the original calculation in each case. A much more useful and satisfactory one is the following, which is very easily read, and from which the calculation necessary may be made in a few seconds.

Fig. 104.



To calculate the Duration of Pregnancy. (After Schultze.)

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Around the circle are arranged, in their order, the months in the year, with the number of days in each. The number placed below each month gives the number of days which must be added to the nine preceding months in order to make up 280 days. If the month of February in a leap year is included in a pregnancy, it is estimated by the number in brackets.

We reckon in order to find the next 280 days from the starting point (the last day of menstruation), nine months forwards (or more simply, three months backwards), and add to the date thus reached the number standing below the name of that month.

Example 1.—Last menstruation, the 10th of February, count three months back = November 10th + 7 = November 17th (in leap year, November 10th + 6 = November 16th).

Example 2.—Last menstruation, 24th March, = 29th December, = 280 days.

Example 3.—Last menstruation, 30th September, = July 7th, = 280 days.

Example 4.—Last menstruation, 31st May, = March 7th, = 280 days.

The last example shows how to proceed when, at the end of the month, there may be a doubt as to the calculation.

The 31st of February is equivalent to the 3rd of March which + 4 = 280 days.

An equally simple calculation may be made when, in medico-legal investigations, we want to calculate backwards from the day of birth to the probable cessation of the menses 280 days previously. In this case, we count three months forwards, and *subtract* the number standing under the birth-month.

Example 1.—Birth, 31st October, = Menses, January 31st, - 7 = January 24th, or 280 days.

Example 2.—Birth, 20th April, = Menses, July 20th, - 6 = July 14th, = 280 days.

Impregnation may take place at any time during an inter-menstrual period. It is believed, however, that the time at which it most frequently occurs is about seven days after the last menstruation, and that the epoch next in point of frequency is immediately before what would have been the succeeding menstrual period. It will be observed that we have thus a range of three weeks within which impregnation *may* occur, even when the menstruation is quite regular, and this fact serves to explain, as we believe, the great majority of those cases in which a woman appears to carry the child for three weeks beyond the calculated time. Indeed, when a woman goes one week beyond the 280 days, we have come to look upon it in practice as by no means unlikely that she will carry her child for fourteen days more.[1]

Date of Quickening.—The errors which arise from this method of calculation are of such frequent occurrence, that we find it of great advantage, when practicable, to correct this observation by another, as has already been incidentally observed—to wit, the quickening. In regard to this sign of pregnancy, there certainly exists much self-deception on the part of women, and, moreover, it is, as Dr. Reid remarks, seldom that they can tell us the exact day on which they first feel it. The vulgar belief is that the period when it is first felt indicates the middle of pregnancy, or four and a half calendar months; but the opinion of the most experienced accoucheurs is, that it is, as a rule, perceived about the end of the fourth calendar month, or about a fortnight before the middle of the term.

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[1] This term of 280 days is of special interest from another point of view, as marking the tenth menstrual period from conception. (See *Causes of Labour*, Chapter XV.)

About the *seventeenth* week, therefore,—dating from menstruation,—may be set down as the most usual period. Its value, as a sign of the duration of pregnancy is unfortunately much diminished by the uncertainty of the period at which it may for the first time be experienced; but, still, its value is very considerable in this way, that, if we have a case to deal with of apparently protracted pregnancy, it is unlikely that any considerable error should arise both as regards the quickening and the last menstruation in the same case. By this precaution, therefore, the risk of miscalculation is certainly diminished.

When, as is usual in midwifery practice, the services of the accoucheur are engaged beforehand, he should, for his own satisfaction, uniformly ascertain the date of the last menstrual flow, and not be content with the scanty information usually given that she expects her confinement "early in the year," or "about the middle of June." Having ascertained the fact and noted it, he must then inquire as to the quickening, and if the information is sufficiently clear, he must note that also. Or, if the woman has not yet arrived at the period of her pregnancy when this sign manifests itself, she must be requested to make an accurate note of her quickening, with a view to the subsequent information of her medical attendant. With the facts thus disclosed before him, he may then, by an application of the principles already laid down, make a calculation, which with ordinary care and discrimination, will rarely mislead him.

Superfœtation.—It is generally, although not universally, admitted by those who have devoted most attention to the subject, that it is quite possible for one impreguation to succeed another, in the same pregnancy, within a certain limited period, and it is all but proved that, in this manner, twin pregnancies do occasionally occur. This is not, however, superfœtation, but merely *superfecundation;* the essential distinction between the two being, according to Scanzoni, that the former must be held as occurring after the period at which the decidua vera and decidua reflexa come into close contact. It is quite certain that the orifice of the Fallopian tube remains, during the early months of pregnancy, quite patent; and that the mucous plug in the os internum does not hermetically close the cavity. In fact, the anatomical conditions are such that, but for the fact that the maturation of ova does not usually go on during pregnancy, the difficulty would rather be to discover why superfecundation was not more common. Physiologically, the real impediment lies in this fact, that the highest function of the ovary remains in abeyance from the period of conception till some time after delivery. If, therefore, ovulation should exceptionally go on—which Dr. Matthews Duncan supposes may be indicated by unusual instances of menstruation during pregnancy—there is no difficulty in admitting the possibility of superfecundation under such circumstances.

It is otherwise with Superfœtation, the possibility of which has been vigorously opposed by Wagner, who termed it a physiological impossibility; and by most of the modern English writers, among whom we may mention Drs. Ramsbotham and Churchill. The idea implied is, that a woman who already bears within her womb a living fœtus may, at a stage of pregnancy more advanced than that at which the two deciduæ come in contact, again conceive, and thus carry simultaneously the fruit of two conceptions, between which there must be a considerable interval. A careful analysis of the so-called cases of superfœtation, and especially of the older cases, shows conclusively that, in most of them, the phenomena were quite consistent with the idea of ordinary twin pregnancy. Numerous cases are on record where, abortion having taken place, one twin has then been expelled, while the other has gone to the full time. Others, again, occasionally occur in which a mature child and a small withered one are born together. But it needs no argument to show that, although instances such as these may excite surprise among the ignorant, they are quite in keeping with what is known of the physiology of twin pregnancy. A number of the recorded cases are so obviously to be accounted for in this way, that we are almost tempted to refer, without any further investigation, all such to the same category. But an impartial consideration of the numerous examples which have been advanced in support of superfœtation will not permit such a summary treatment of the subject.

Among the cases frequently quoted, is one which was published in the Transactions of the College of Physicians.

> "Mrs. T., an Italian lady, who was married to an Englishman, was delivered of a male child at Palermo, on the 12th of November, 1807; and on the 2nd of February, 1808, she was delivered of a second male child." Both children were said to have been born perfect, but a careful analysis of the whole facts as disclosed, seems to show that the case in all probability comes under the class of twin pregnancies. Certain doubtful circumstances regarding the first infant, coupled with the fact of its early death, seem to point to the conclusion that it was born immature.

Dr. Möbus of Dieburg reports a similar case, the narrative of, and remarks upon which we take from Taylor's well-known work on Medical Jurisprudence.

"A healthy *married* woman, about thirty-five years of age, was safely delivered of a girl on the 16th of October, 1833. The child is described as having been well formed, and having borne about it all the signs of maturity. This woman, it is to be observed, had previously had several children in a regular manner. Soon after her delivery, and the expulsion of the placenta, she felt, on this occasion, something still moving within her. On examination, the mouth of the uterus was found completely contracted, and the organ itself so drawn up as to render it difficult to be reached: but the motions of a second child were still plainly distinguishable through the parietes of the distended abdomen. Her delivery was not followed by the appearance of discharge (lochia) or by the secretion of milk. The breasts remained flaccid, and there was no fever. On the 18th of November, *thirty-three* days after her first confinement, this woman, while alone and unassisted, was suddenly delivered of another girl which, according to Dr. Möbus, was healthy, and bore no sign of *over-maturity* about it.' The reporter alleged that this case most unequivocally establishes the doctrine of superfœtation. The two births took place at an interval of thirty-three days, and the two children were, it is stated, when born, equally well-formed and mature; but Dr. Möbus did not see the second child until twenty-four hours after birth. This may, however, have been a twin case, in which one child was born before the other. Dr. Möbus considers that the first child was born at the usual period of gestation, it being described as mature; and that the other, thirty-three days after that period, having been, in his view, conceived so many days later than the first child. If, however, we imagine that in this, as it often happens in twin cases, one twin was more developed than the other, and that the more developed was the first expelled; or that it is not always easy to compare the degree of development in two children, when one is born before the other, and the two are not seen together, we shall have an explanation of the facts, without resorting to the hypothesis of a second conception after so long an interval. As to the signs of *over-maturity* alluded to, they are not met with. If we are to believe authentic reports, a child born at the thirty-ninth week cannot be distinguished from one born at the forty-third or forty-fourth week, and children born at the full period vary much in size and weight. A longer time may be required to bring children to maturity in some women than in others; and in a woman with twins, it is well known that two children may arrive at the same degree of maturity within different periods—one requiring perhaps several weeks longer than the other for its full development."

In a most interesting paper by Dr. Bonnar of Cupar-Fife,[1] a number of cases are given in which children, born in wedlock, succeeded each other with very unusual rapidity. The question of superfœtation is here looked upon from a different point of view, in reference more particularly to the period after parturition at which the female procreative organs are again capable of exercising their functions. Dr. Bonnar gives three cases, in which there intervened between the two deliveries 182, 174, and 127 days, and all the children were sufficiently developed to be reared, and, without exception, to reach maturity. How are we to explain these facts? We know that impregnation may occur within a very short period after delivery, long before the mucous membrane has gone through the process described by M. Robin, and become restored to its normal state. But, in the case last mentioned, this would only give about four calendar months from an impregnation assumed to date from six days after the last delivery, an age at which it would not be possible to rear the child, even upon the assumption of its being a case of so-called *graviditas præcox.* If we reject this theory, and yet admit the facts, which we believe to be beyond question, there is only one other way of accounting for them, and that is to admit the possibility of superfœtation.

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[1] Edinburgh Medical Journal. January, 1865.

Now, in regard to much of what has been urged in evidence against the possibility of superfœtation, it must be admitted that it is either irrelevant or inconclusive. Many, even of those who admit the probability, within certain limits, of superfecundation, assume that a new conception is impossible—say in the second or third month—on account of mechanical impediments which exist so soon as the decidua is formed. We know, of course, that the complete development of the decidua reflexa is a barrier to the formation of another embryo within the pouch which it forms; but the researches of Coste most conclusively show, as has already been mentioned, that neither the Fallopian tubes nor the cavity of the cervix are closed so as to prevent communication between the vagina and the ovary. Or, to speak more plainly, there is no mechanical, nor, if the function of the ovary be not arrested, is there any physiological *impossibility* that a new ovum might be fertilized at any period prior to that at which the decidua vera and the decidua reflexa come into contact, and be developed in a special decidual sac. But some of the last cited, if they are to be taken as cases of superfœtation, would seem to point to a new impregnation at a period later than that at which the two decidual layers come into contact; a difficulty which is ingeniously got rid of by Dr. Matthews Duncan, who says, "if we suppose, in an instance of this kind, that the first child is born prematurely, but within the limits of viability, we thus gain two months; and, if impregnation may take place between two or three months after conception, we have thus four or five months of interval accounted for between the births of successive viable infants."

In Extra-Uterine Pregnancy.—It is generally admitted that superfœtation may take place in the course of extra-uterine pregnancy. This, taken in connection with the facts hitherto ascertained with reference to menstruation during pregnancy, seems to indicate pretty clearly that the function of the ovaries is not necessarily interfered with in the course of gestation; but, at the same time, cases of this nature must be considered as standing by themselves and not affecting directly the ordinary question of superfœtation. An example of this is reported by Montgomery, in which, while the product of an extra-uterine gestation remained encysted within the abdomen, the woman bore three children, one of whom lived. A similar case has been recorded by Dr. Steigertahl; and another still more interesting by M. Cliét, of Lyons, in which a woman died suddenly, and, upon dissection, an extra-uterine fœtus of five months was found in the abdomen, while a fœtus of three months occupied the uterus.

In Double Uterus.—In another group of cases, of which many are on record, a second impregnation takes place, and development goes on within the unoccupied cavity of a double uterus. Of these, few present features of greater interest than one which was brought under the notice of the author by Dr. J. Harris Ross of Brighton. It was embodied by him in his graduation thesis at the University of Glasgow in 1871, and was subsequently published in the Lancet. The following is Dr. Ross's report:—

"Mrs. C——, the subject of these remarks, is a woman aged thirty-three. She has been married fourteen years; and previous to the circumstance I am about to relate, had been delivered of six children. With the last three I was the medical attendant; but had never before had the opportunity of examining the uterus, as the child on each occasion was quite at the outlet of the vagina when I arrived at her house. With the exception of once (when she was prematurely delivered of a seven months' child) the labours were all natural, and she always made a good recovery.

"She sent for me in May, 1870, as she had considerable hæmorrhage. She told me that she was pregnant, and that she had not menstruated since the previous February. On examination, I found the os uteri very flaccid and partially open, and another opening close to the left of it, which I supposed to be an excavated ulcer, and the cause of the hæmorrhage. As she objected to the use of the speculum, I ordered her to keep the recumbent posture, and to use an astringent injection, which I sent her, together with some tonic medicine. In a few days the hæmorrhage ceased, and she got about her household duties until July 16th.

"On the morning of that day she sent for me in a great hurry. I found her with strong labour pains; and on making an examination, I found a bag of membranes protruding from the uterus, which ruptured during my examination. After this the pains left her. I saw her several times in the course of the day, but the pains did not return until about nine o'clock in the evening, when they were of a very feeble character. On examination at this time I found another bag of membranes protruding, which I ruptured, as I thought it might stimulate the uterus to contract. A head then presented, and, after some time, the pains being very feeble, a fœtus was expelled. On again examining, a leg presented, and after a while I delivered her of a second fœtus, and then of a double placenta—that is, one with two cords. The children were, I should judge, of nearer six than five months' growth. After I had removed the placenta, the patient exclaimed, 'I am sure there is another, Mr. Ross,'—meaning another child. As the uterus felt rather bulky, I introduced my hand into the vagina, and my finger into the uterus, to make sure, but found the cavity quite empty. At this time the second opening in the uterus was plainly to be felt. The whole course of this labour was very different from her other ones; the pains were very feeble, and the labour unduly long: this I attributed to her having twins.

"About a week afterwards, the patient again declared that she had another child in the womb; but I pooh-poohed it, as I had made such a careful examination after delivery, that I felt certain I could not have left one behind. She, however, persisted in her statement. One day I went to see her, and my hand being very cold, I placed it upon her abdomen, when I plainly felt the movements of a child, and on applying my stethoscope the fœtal heart was quite audible. On examination, *per vaginam*, the two openings could distinctly be felt, when it at once dawned upon me that I had got a case of double uterus, with both sides impregnated at the same time. On introducing a sound into the apertures, there was no doubt they both opened into a cavity or cavities, but, as she was still pregnant, I did not then push the matter further. When laid flat upon her back the tumour in the abdomen was decidedly more to the right than the left side. As there was now no doubt about her being pregnant, I told her to send for me directly she was in labour.

"She went on well until the morning of October 31st, when she sent for me at 6 A.M. On my arrival, I found the head on the perineum, with the membranes protruding. I ruptured them, and delivered her of a female child of full growth in about a quarter of an hour afterwards. On examining the uterus (after removal of the placenta) I could get my thumb into one opening, and, by a little manipulation, my finger into the other, and could distinctly feel a septum between them. She stated that she had menstruated three times since her miscarriage of twins in July. Both mother and child made a good recovery."

The conclusions, then, with reference to this subject, at which we think we are justified in arriving, are,—1st, That in regard to Superfecundation, this is a phenomenon the existence of which there is no reason to doubt; 2nd, That in so far as cases of double-uterus and extra-uterine pregnancy are concerned, Superfœtation is established beyond question; and 3rd, That with respect to other cases (to which alone, perhaps, the term Superfœtation should properly be applied), a large number of recorded cases are merely twin pregnancies. A strong presumption is, therefore, established that, up to the period when the decidua reflexa comes into contact with the decidua vera, and probably until the two have become intimately adherent, there is a possibility of a new impregnation. Beyond this period we believe it to be impossible.

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CHAPTER XI.

PLURAL PREGNANCY : EXTRA-UTERINE PREGNANCY.

PLURAL PREGNANCY.—*Mode of Impregnation.—Twins: Disposition of the Membranes and Placenta in: Diagnosis of: Unequal Development.—Premature Labour frequent.—Triplets, &c.*—EXTRA-UTERINE PREGNANCY.—*Varieties of: Ovarian: Tubal: Tubo-Ovarian: Abdomino-Tubal: Tubo-Uterine, &c.: Abdominal.—Causes of Extra-Uterine Pregnancy.—Development of the Ovum and its Coverings.—Sympathy of the Uterus.—Symptoms.—Progress of in Different Varieties: Rupture of the Sac: Peritoneal Inflammation: Discharge of Fœtal Debris.—Terminations.—Treatment.*

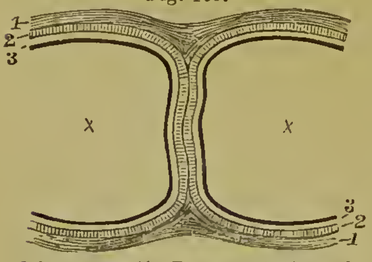
THE term Plural Pregnancy may be held to include all cases in which two or more ova are fertilized, simultaneously or nearly so, and are together developed within the uterine cavity. The products of conception in these cases are termed twins, triplets, quadruplets, &c., according to their number. It has been observed that certain women are peculiarly prone to plural conceptions, that those, for example, who have once born twins are much more likely to carry two children again than those who have not; and facts are not awanting to show that, in some instances at least, there is a marked hereditary tendency. Whether such pregnancies are or are not the result of separate acts of insemination, is a question in regard to which we cannot venture beyond conjecture. Many facts, such as the birth of twins of different colour, have been observed, which seem to show that successive acts within a limited period may be the cause of the impregnation of separate ova. But it is in the highest degree improbable that this is always the case, for there is no reason to believe that, if the semen comes into contact at the same time with two mature ova, one only is to be fecundated, and the other passed over. We shall not pause here to consider whether or not we are to explain the fact of the frequent unequal development in multiple pregnancies by the doctrine of superfecundation, but nothing is so common in this class of cases as to find one child well developed and vigorous, while another is weak and puny.

Twin Pregnancies.—These occur once in about 75 to 80 cases, and Triplets certainly not oftener than once in 5,000. Cases where the number of children is greater are extremely rare. It was for long doubtful whether two embryos which were being simultaneously developed belonged to the same or different ova, and whether, in the last case, these ova proceeded from the same ovary. Modern research has in reference to these points established the following propositions:—1st, that two yolks are occasionally found in a single ovum; and that the germs contained in them are probably simultaneously fertilized:—2nd, that two ova may exist within a single Graafian vesicle, from which, on its maturity, they may escape and be fertilized, together or successively:—3rd, that two ova may be formed within two Graafian vesicles in the same ovary, or one in each ovary, the latter of which is proved by the simultaneous occurrence of pregnancy in each cavity of a double uterus (see Dr. Ross's case, quoted at p. 211). In these cases, two corpora lutea are found in the same stage of development.

The following varieties of twin pregnancy—the distinction between which depends on the arrangement of the membranes, cord, and placenta—are those which are generally observed in practice. The essential difference between them depends, as a little careful examination will show, upon whether two ova have been impregnated, or a single ovum has contained two germs.

The Membranes of Twins.—The cases which occur most frequently are those in which two distinct ova are impregnated, whether they come from separate ovaries, from two Graafian vesicles in one ovary, or from a single Graafian vesicle. Each of these becomes embedded in the mucous membrane of the uterus, and the decidua reflexa rises round it in the usual way. In the process of growth, the two tumours approach each other and come into contact, forming thus a partition between the two cavities, which originally consists of six layers, the decidua, chorion, and amnion, proper to each embryo. It would seem, however, according to the observations of Guillemot and others, that the decidua forms a very thin layer in the partition, or is absorbed, so that the partition at maturity consists of four layers only, consisting of the amnion (3 3)

Fig. 105.

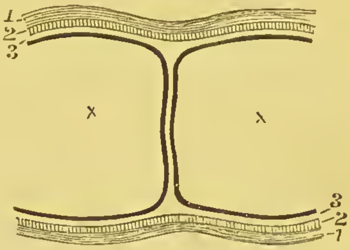


Diagrammatic Representation of Partition in Twin Pregnancy (1st Variety).

and the chorion (2 2) on each side, the whole mass being enveloped in a single decidua (1 1). In these cases the placentæ, developed, as will be remembered, on the maternal and fœtal sides, from the decidua and chorion respectively, are sometimes completely separated, the one from the other. In other instances, again, they are fused together into a single mass, or are united by a sort of membranous bridge. But, as a rule, in spite of this continuity of tissue, there exists no vascular communication between the two.

In another class of cases, which are of comparatively rare occurrence, there is a chorion (Fig. 106, 2 2) common to both embryos, each, however, being enclosed in its own amnion (3 3), the common decidua (1 1) surrounding the whole, as in the former case. In these instances there is a single placenta, and very frequently ramifications exist between the branches of the two cords. There can be no doubt that here there must have been impregnation of two germs within a single ovum; or, in other words, they are cases of double yolk.

Fig. 106.



Twin Pregnancy (2nd Variety).

It occasionally occurs that two embryos exist in a common amnionic cavity,—a fact which it is difficult to explain on any other hypothesis than that they originally belong to the second variety, and that the amnionic partition in Fig. 106 is absorbed in the course of development. But even if we go so far as to admit this theory to be in all probability the correct one, we are by no means justified, in the present state of our knowledge on the subject of Ovology, in rejecting all other theories which may be advanced. There is, for example, nothing irreconcilable with the views of development which have been given in an earlier section of this work, in the idea that two embryos may be developed on the continuous surface of the blastodermic vesicle. We do not doubt that it is improbable, but we cannot admit that it is, as some say, impossible. The two cords have generally been observed, in these cases, to spring from separate points on the placenta; but they have been found, in a few rare instances, to spring from a common trunk, which bifurcates at a variable distance from the placental surface. In the cases of twin pregnancy in which one fœtus is deprived of an important part of its body, it has been frequently found along with a perfect twin in the same amnionic sac.

A fourth variety of twin conception is that which has been described by Ollivier and others, under the name of *monstrosity by inclusion.* This consists in the presence, within an otherwise perfect fœtus, of the elements, more or less distinct, of another, which may be situated either within the abdominal cavity or beneath the skin—usually in the neighbourhood of the perineum or scrotum.

Diagnosis of Twins.—It is often possible, during the currency of a pregnancy, more especially during the weeks immediately preceding delivery, to recognise the presence of twins. Generally speaking, when there is, as is usual, a fœtus on either side of the uterus, the shape of the organ is less ovoid than usual, there being more enlargement in the direction of the sides. The woman may complain of movement at separate points of the abdomen,—an observation which, although far from being conclusive evidence of the presence of twins, seems to be, in certain cases, of some practical value as a symptom. If the abdominal wall be thin, it may also be possible for the accoucheur to perceive these movements by palpation, and, in the course of the same examination, even to recognise the presence of a second fœtus. There is greater distension of the abdomen, and an aggravation of such symptoms as are the result of pressure on neighbouring organs. The pulsation of the two fœtal hearts may be heard at different points on the abdominal surface, and there may be, as has already been mentioned, a want of synchronism in the sounds. Ballottement is not practicable. The uterine souffle is unaltered. These signs are, however, often vague and unsatisfactory, even in those cases in which a suspicion of twin pregnancy has arisen ; and, in the majority of instances, the fact of the plural pregnancy is only recognised in the course of labour.

Unequal Development.—Whether as the result of superfecundation, or simply of unequal development, cases are very frequently met with in which the infants are of different size. In others, the growth of one fœtus is arrested, and it dies. The results, in such cases, vary considerably, being influenced by various circumstances, among which we may assume that the mode of disposition of the membranes is not the least important. In a certain number of cases, the dead fœtus is retained, but there being no access of external air, no putrefactive change takes place. It becomes hard, withered, and mummified, and in this state it may be born with the mature fœtus at the termination of pregnancy. This may happen whatever may be the nature of the partition between the two, and even, as some believe, in the cases in which they are in a single amnionic cavity; but it is, we apprehend, likely that Baudelocque is correct when he assumes that, in the latter, the death of one necessarily places the life of the other in great jeopardy. In other instances, the dead fœtus acts as a foreign body, or in some other way incites the uterus to contract, the result being usually the expulsion of the living and the dead ; or the dead fœtus is expelled, and the uterine action being arrested at this point, the living one is retained, and ultimately fully developed. This last can, for reasons which a moment's reflection will render obvious, only take place when each fœtus is enveloped in a complete series of membranes. If there be a common chorion, and, *a fortiori*, if there be a common amnion, the expulsion of one necessarily involves the expulsion of the other. In yet another group of cases of this nature, both are are retained; but when labour comes on, the mature and living child only is expelled, while the withered fœtus remains behind, and may possibly occupy the womb for a very considerable period. The cause of the death of one fœtus in these cases is not well understood, but, probably, they who believe it to be due to some form of degeneration of the placenta or the membranes, or to some disease in the fœtus itself, are correct in their supposition.

Premature Labour Frequent.—It has been observed, with reference to multiple pregnancies, that they frequently terminate before the full period of gestation has been reached. This we may assume to be due to the over-distension of the uterus, which excites it to contraction at a period somewhat earlier than usual. As a rule, both children are generally expelled in the course of the same labour, in some instances without even a pause in the uterine effort. This is, however, far from being invariable, as it is not uncommon for the action to cease, and to return again in eighteen, twenty-four, or even forty-eight hours, when the uterus is thrown anew into periodic contraction, and the labour goes on in a perfectly regular and normal manner. In very rare cases, the interval between the two births may extend to a period of weeks, or even of months; and there can be no doubt that many of these cases have given rise, on erroneous grounds, to a belief in the theory of superfœtation, the error arising from the fact that the immaturity of the first child is overlooked.

It is unnecessary to make further mention of the other varieties of multiple pregnancy, as the observations which have been made may be held, *mutatis mutandis*, as applicable to these also. To judge from the few cases in which observations have been made, it would appear to be rare that each fœtus, the number being more than two, is enclosed in its own complete sac. Several cases of triplets, are, for example, recorded, in which one had a special sac, while the other two had a common amnion. In regard to the possible retention of one or more of them, we may well suppose, to judge from analogy, that any conceivable combination of the numbers is in this respect possible. The practical bearing of plural pregnancy on the progress of labour will be noticed hereafter.

Extra-uterine Pregnancy.—Although the cavity of the womb is the site which nature has specially prepared for the development of the fruit of conception, it occasionally happens that it goes through its characteristic phases of development elsewhere. Generally, in these cases, its growth is arrested at a stage considerably short of maturity; but many instances have occurred in which the full period of gestation has been reached, and some in which it has been considerably exceeded, although the cavity of the uterus was entirely empty, as in the virgin state. The ovum is, as has been shown, developed within the ovary in the Graafian vesicle; and what has been observed in the lower animals leads us to conclude that, while yet it occupies that situation, and even before the rupture of the vesicle has occurred, impregnation may take place. On the bursting of the vesicle, it passes along the groove on the inner aspect of the fimbria which is in permanent connection with the ovary, and is received into the infundibulum or pavilion of the Fallopian tube, whence it is conducted slowly through the entire length of the tube, until it reaches the uterine cavity, where its subsequent development progresses until the moment of delivery. Such we know to be the law of nature. Constituting an exception to this law, the ovum may, however, be arrested and take root at any point of its course, while the vital processes of development go on, up to a certain point, as actively and as efficiently as if the ovum had passed on to its usual site. In other cases it may deviate from its normal channel, falling into the cavity of the peritoneum, to some portion of which it attaches itself. These are the circumstances which give rise to extra-uterine pregnancy, and cases as they occur are classified more or less elaborately according to the anatomical relations which the ovum assumes in its unwonted situation. The usual division is into Ovarian, Tubal, and Abdominal cases, with many sub-divisions, the more important only of which will be noticed.

Ovarian Pregnancy.—The existence of Ovarian pregnancy has, by Mayor, Velpeau, and others, been absolutely denied. The denial seems, however, to have been founded on the assumption, which we believe to be unwarranted, that impregnation is impossible without rupture of the Graafian vesicle. But, even if rupture has taken place, it is not inconceivable that a fertilized ovum should remain and become, at least partially, developed within the Graafian vesicle.[1] This is what has been termed the "internal" variety of ovarian pregnancy, as distinguished from the "external" form, in which the ovum is attached to the surface of the ovary. It is probable that, while the latter may more properly be classed as "abdominal," or "tubo-ovarian," it is the former alone which should receive the name of "ovarian" pregnancy; but it must be confessed that, in this sense, internal or true ovarian pregnancy involves an assumption which, among modern physiologists, is far from being universally accepted.

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[1] This, we observe, is the view taken by Dr. John S. Parry in his exhaustive and able treatise :—Extra-Uterine Pregnancy, its Causes, Species, &c. Philadelphia, 1876.

Tubal Pregnancy.—Of all the varieties of extra-uterine gestation, the most common, by far, is the Tubal, which, for the reasons already stated, is precisely what we might anticipate. The ovum in its descent towards the cavity which awaits it, is arrested, it may be at any one point of its course, and there contracts adhesions, forms its membranes and placenta, and is thus surrounded, in lieu of a uterus, by a sac which is formed of the dilated and hypertrophied walls of the Fallopian tube. For greater precision in description, various names have been assigned to such pregnancies, according to the exact point at which the arrest of the ovum takes place. Those quite at the fimbriated extremity of the tube, which either are originally, or come to be in course of time, in contact both with tube and ovary, are termed *tubo-ovarian.* When the ovum is stopped at the point where the tube first narrows, the development may take place partly within the tube, where the placenta will probably be situated, and partly bulging into the abdominal cavity, in which direction the growth mainly advances: to this variety the name *tubo-abdominal* has been given. Between this point and the uterine wall is the situation at which the ordinary and most common form of extra-uterine pregnancy occurs. Several varieties have been described of cases in which the ovum has its seat in the immediate vicinity of the uterine cavity, of which the most important and interesting is the *utero-tubal,* where the ovum lodges in that portion of the tube which passes through the walls of the uterus. The development in such a case may be partly within the uterus and partly within the tube; or, when a little more external, it may develop actually within the parenchyma of the uterus, and, if projecting into the cavity, may be invested with a covering of muscular fibres derived from the uterus itself. This is, probably, the *graviditas in substantia uteri* of the older writers.

Among the rarer varieties is that, of which an example is given by Burns, in which the placenta is found in its normal situation within the uterus, and the fœtus within the Fallopian tube; and, still more rare are those of which Hunter, Hoffmeister, and Patuna have given illustrations, in which the fœtus has been found in the abdominal cavity, and the placenta in the uterus—the two being connected by a cord which ran from the placenta for some distance within the Fallopian tube, and then perforated it to join the fœtus. These latter cases have been called *utero-tubo-abdominal;* and, in reference to them, we may assume that they were originally cases of tubal pregnancy, in which the placenta had been developed within the uterus, while the fœtus had escaped into the peritoneum by rupture of the walls of the sac in which it had been contained. Another rare form has been described as *sub-peritoneo-pelvic*, in which it is assumed that the ovum has got between the folds of the broad ligament, and there developed itself. This may happen in two ways; either by failing to escape from the Graafian vesicle within which it has been impregnated, and insinuating itself at the hilus between the layers, or by a tubal pregnancy taking this direction instead of the usual one towards the peritoneal cavity by the free surface of the tube. It has been justly observed that, when this variety does occur, a more favourable result may be anticipated than in the other forms; because, in such a situation, the debris of a dead fœtus may be more easily and more safely removed.

Abdominal Pregnancy.—In the abdominal form, the fertilized ovum falls into the cavity of the peritoneum, to any portion of which membrane it may in fact become attached. We may thus find it firmly incorporated with the broad ligament, the intestines, the colon, and any other parts to which continuity of tissue permits its access. The essential physiological difference between an abdominal case and the other varieties of extra-uterine pregnancy is that, in the former, the ovum is without any special covering which can correspond to that which, under other circumstances, it derives from the tube or other investing structure. It grafts itself, so to speak, upon the peritoneal surface of some viscus or of the abdominal wall; and if it is subsequently covered with any special covering, that must be the result, physiologically, of special evolution, or, pathologically, of inflammatory action.

Causes.—Little has been discovered which enables us to come to a satisfactory conclusion, in regard to any of the above varieties, as to the causes of extra-uterine gestation. Many have believed that a shock or fright, or a blow on the lower part of the belly may give rise to it, should this chance to coincide with the moment of conception, and they ground this belief on facts which women have from time to time communicated. No single observation affords, however, to this theory, even the shadow of a proof, and the so-called evidence on which it rests, may perhaps be attributed without impropriety to that love of the marvellous which exists in so many minds. We cannot doubt that certain pathological conditions might furnish the cause, and, in some instances, the existence of such pathological conditions has been established. Inflammatory action of any kind, induration, pressure exercised by morbid growths, spasm of the muscular fibres of which the tube is so largely composed—so as to cause stricture—are a few from among many conditions which might be specified as *possible* causes of the phenomena. The fact is, however, that in most of the cases in which a careful examination has been made, the course of pregnancy so alters the anatomical conditions of the chosen site, that it is impossible to come to any satisfactory conclusion as to the original condition of the parts. Some very curious phenomena have been observed, showing that the ovum is sometimes very erratic in its course. How otherwise are we to explain the facts observed in Dr. Oldham's cases, in which there was a distinct *corpus luteum* on one side, and tubal pregnancy on the other? For we must accept, as Dr. Tyler Smith says, in reference to one of these cases, one of three explanations. "The unimpregnated ovule might have been swept by the cilia of the peritoneum from the right ovary to the fimbriated extremity of the left tube; this would be similar to what occurs in the Amphibia, in which the ova always traverse the abdomen to reach the oviduct. Or the left tube may have reached over to the right ovary and have taken up the ovule. According to the third explanation it might be that the ovule had descended the right tube, entered the uterus, and then ascended through part of the left tube by an anti-peristaltic action, or by the ciliary currents which move from below upwards." The view which Dr. Tyler Smith preferred in regard to the case in question was the third; while Dr. Oldham and Mr. Wharton Jones were inclined to accept rather the second of the explanations offered. Certain experiments, however, in the lower animals would rather tend to establish the greater probability of the first theory after all being the correct one. It seems at least to have been proved that the spermatozoa may ascend by one tube, and, by crossing to the region of the ovary on the other side, there impregnate an ovum to which access is impossible by the corresponding tube on the same side.

In every form of extra-uterine pregnancy, the ovum forms its own membranes, and goes through the various phases of evolution in all respects as if the pregnancy were normal. It is therefore in every case covered by its own amnion and chorion, without which, indeed, further development were impossible. So far all cases are alike. But in regard to the further coverings of the fœtus which, external to those just named, are of maternal origin, and correspond to the decidua and the uterus, great differences exist according to the class of extra-uterine pregnancy to which each case is to be referred. It is probable that in tubal pregnancy the mucous membrane may form, as in ordinary cases, a special envelope strictly analogous to the decidua serotina, although as regards a decidua reflexa, it would appear that it has rarely been demonstrated in such cases. It is clear, however, that, in every instance, the sac within which is contained the fœtus and its special structures, is composed of the mucous, muscular, and serous layers of the Fallopian tube, which become distended, and at the same time hypertrophied, as the ovum grows. In true ovarian pregnancy, the sac must consist originally of the walls of the Graafian vesicle, and of the special coverings of the ovary itself; but, in the compound forms, the sac may be partly tubal and partly ovarian, or partly tubal and partly uterine, the covering depending simply in each case upon the site at which the ovum becomes arrested.

Cases of Abdominal pregnancy differ materially from all others in this respect, and stand on that account in a class by themselves. The ovum is not in this variety arrested at any point of the canal through which nature intended it to pass, but escapes altogether from that canal and falls naked into the great abdominal cavity, without any special covering whatever, unless it be some remains of the granular disc in which it was embedded. Here, in the early stage at least, there can be no special covering, nor connection with the maternal parts other than mere juxtaposition, the result of gravity or some other accidental circumstance. If the ovum has not, prior to this, been fertilized, it will no doubt rapidly disappear, and be absorbed with the secretions of the peritoneal surface. But if, on the other hand, an independent vitality has been communicated to it by conception, it bears the life which it contains to some point accidentally selected, and having there grafted itself upon the subjacent part, the essential contact between the maternal and fœtal systems is established, and the subsequent stages of development ensue. There can thus be, in the first instance, no sac whatever; but such facts as have hitherto been disclosed, as well as all reasoning from analogy, point to the conclusion that nature provides, by a development from the peritoneal surface, a maternal envelope corresponding to the uterine decidua. But, should rupture of the membranes of the ovum occur, another covering may be provided by a very different process. The embryo, which then escapes into the abdominal cavity along with the liquor amnii, instantly becomes a foreign body, and, by exciting inflammatory action, provokes the development of coagulable lymph. This, under favourable circumstances, may form a sac around the ovum, enclosing it now in a special cavity, and protecting the rest of the peritoneal surface from the dangerous effects of extensive inflammation, which would inevitably ensue from the prolonged contact of the fœtal remains.

Whatever the site may be, abdominal or otherwise, at which the fertilized ovum takes up its position, the speedy result is a marked increase in the vascularity of the contiguous parts. If, for example, it becomes adherent to the peritoneal surface of any portion of the bowel, the blood-vessels of that part will at once become the seat of a marked and wonderful hypertrophy. What were before minute twigs now become large venous trunks, and the arterial supply is of course proportionally augmented. The vessels being projected from the embryo to the chorion by means of the allantois, the vascularity of that membrane is at once established. Those of its villi which belong to the visceral surface undergo marked development, and contract still closer adhesions with the peritoneum. The whole of the tissues become at this point enormously developed, and thus the Placenta is formed, within which the interchange of gases and materials goes on smoothly and, for a time, safely.

Changes in Uterus.—During the development of an extra-uterine fœtus, certain changes more or less marked have been noticed to take place in the uterus at an early period of the pregnancy. These changes, in so far as they have hitherto been observed, seem to be identical with the preparatory process of which the uterus is the seat at the time of impregnation, prior to the descent of the ovum. They consist in a marked increase in the size of the organ, in an equally marked increase in its vascularity, and in the characteristic thickening and hypertrophy of the mucous membrane, which is the first stage in the formation of the decidua.

Symptoms.—The symptoms of extra-uterine pregnancy are far from being definite and distinct. Just at first, the changes which have been mentioned as occurring in the uterus would, no doubt, tend to suggest the idea of an ordinary pregnancy. The woman may, at this time, enjoy perfect health, disturbed only by some of the sympathetic digestive disorders which are so familiar. No reliance can be placed on the cessation of the menses as a sign, as, from the narrative of recorded cases, it would appear that although the discharge sometimes ceases, what is much more frequently observed is a recurrence at irregular intervals of *hæmorrhagic discharges* from the womb. These discharges, indeed, while they deprive us of one of the most familiar signs of early pregnancy, have in themselves a certain diagnostic value which is now generally recognised, more particularly when associated with the other breeding symptoms. Almost invariably, from an early period of the pregnancy, *abdominal pain* is complained of. This may take the form of an intermitting pain, or rather a constant pain with periods of severe exacerbation. It is confined for the most part to a definite region corresponding to the site of the pregnancy, and, consequently, referred, in a large majority of cases, to the groin on either side, when the embryo lies in the tube. In many cases there is, along with uterine hæmorrhage, a *discharge of membrane* which is true decidua, formed as above described, and of great interest and importance from a diagnostic point of view. As the case advances and the ovum grows, considerable discomfort may be caused by pressure, exercised by the tumour, directly or indirectly on neighbouring organs, causing, for example, if the tumour should encroach upon the pelvic cavity, difficulty in defæcation and micturition. Morning sickness, and the various changes which have their seat in the breasts, are of usual occurrence; and, as the case goes on, a tumour may be felt which resembles, more or less closely, the gravid uterus, but which is frequently more irregular in outline and situated more to one side than in the middle line. At the proper time, quickening takes place, and is soon succeeded by the pulsation of the fœtal heart. Should suspicion have arisen as to the nature of the case, it is probable that the absence at this time of the characteristics which are revealed in ordinary pregnancy by a vaginal examination might throw considerable light on the case. If the pregnancy goes on without accident or hindrance till the period which marks the ordinary limit of gestation, pains come on, which are periodic, and which are described by women who have already borne children as precisely similar to ordinary labour pains. "These pains," says Burns, "usually begin in the sac, and then the uterus is excited to contract and discharge any fluid it contains." This uterine effort, at the end of the ninth month, is a physiological fact of surpassing interest, and seems to us to afford strong corroborative evidence of the correctness of that theory which supposes that the cause of labour has its seat neither in the fœtus nor in the uterus, but is, probably, to be found in the ovary, and is to be looked for generally at the tenth menstrual period after impregnation. In weighing the symptoms in a doubtful case, a fact which has already been mentioned in reference to the question of superfœtation should be borne in mind, viz.: that a second (uterine) pregnancy is quite possible; and, indeed, a most striking case is quoted by Montgomery from Primrose, in which a woman went to the ninth month of her seventh gestation, when labour came on as in former occasions, although, ultimately, it turned out that there was a prior abdominal pregnancy.

The cases, however, in which extra-uterine pregnancy is prolonged till the ninth, or even the eighth month, form a very small proportion of the whole. It is, in point of fact, an unusual occurrence when development in such a case continues beyond the fourth or fifth month;

but, on the other hand, cases are on record, which are apparently authentic, in which the life of the fœtus was prolonged within the abdomen for several months beyond the ordinary period. M. Dezeimeris, whose memoir on this subject is justly considered as of great value, states that rupture occurs in more than three fourths of all cases; that in tho tubo-uterine variety, it takes place, as a rule, before the end of the second month; in tubal, in the fourth month; later in ovarian pregnancy; and, in abdominal pregnancy, not till the eighth or ninth month. The usual crisis, then, in all such cases, which may arrive sooner or later in their course, is rupture of the sac and of the fœtal membranes, or of the latter alone in abdominal pregnancies.

Rupture of the Sac.—The symptoms which follow rupture of the sac are of extreme gravity, and the result invariably is that the life of the woman is placed in great jeopardy. The rupture is frequently preceded by severe pains, which may continue for several hours. A sudden cessation of these pains is then observed to coincide with a notable diminution in the size of the tumour. This is succeeded almost immediately by pallor, dimness of vision, vomiting, syncope, and other symptoms which indicate profuse internal hæmorrhage. To these succeed loss of pulse, clammy sweat, convulsions, and death,—or, the bleeding being arrested, the pationt rallies and escapes the immediate danger of hæmorrhage.

If, after rupture of the sac, the hæmorrhage is limited in extent, or if something occurs to check it by favouring the coagulation of the blood, death may not be immediate, but may, nevertheless, take place, as the result purely of hæmorrhage, after an interval of some days; whereas, if the flow of blood be effectually barred, the patient may rally, and the symptoms of impending dissolution may disappear. But the danger which has thus been averted is forthwith succeeded by another equally grave. The fœtus, the amnionic fluid, and the effused blood, arouse violent peritoneal inflammation, which rapidly runs its course, generally with a fatal result. Should the powers of nature be of sufficient energy to overcome this second assault, the effect of the inflammatory action is rather beneficial than otherwise, for the fœtus now becomes enclosed in a sac which is an inflammatory product, and this effectually shuts it out from the rest of the abdominal cavity. Within the new cavity, a process of disintegration or modified decomposition goes on in the greater number of cases. The presence of the fœtal debris excites anew inflammatory action, extending probably to contiguous viscera, between which and the sac adhesions may be established. To this succeeds ulcerative absorption, resulting in the establishment of fistulous openings in the direction of the hollow viscera, or externally through the abdominal walls: or perforation may take place a second time into the peritoneal cavity, with little hope of any result other than a fatal one. But, if the perforation take the direction first mentioned, we may have, for weeks or months, portions of the more indestructible fœtal structures, bones, teeth, and the like, discharged through the abdominal wall, the vagina, the rectum, the bladder, or even the stomach; and, if there be more than one fistulous opening, we may have portions successively or simultaneously discharged through two or more of the channels which have been enumerated. While the discharge of debris is going on, the inflammatory action in the interior of the cyst continues, and is probably aggravated by the admission either of the external air, or of the contents of the hollow viscus into which the opening takes place. Irritative fever of a severe type is thus often set up, and to this, those women who have been so fortunate as to escape the dangers already specified may succumb. In some instances, the course and termination of extra-uterine pregnancy is very different to what has been detailed. The pressure of the tumour may be productive of such annoyance and pain, or may interfere so seriously with the functions of neighbouring organs, that the woman sinks and dies without any rupture having occurred, or even, in so far as can be ascertained, without the death of the fœtus having preceded that of the mother.

Death of the Fœtus.—In another class of recorded cases, the child may die before rupture of the membranes has occurred, a result which we must look upon as favourable in the progress of these cases. For the first result of this is the arrestment of placental circulation, the dwindling of the enlarged vessels on the mother's side, and the consequent abatement in the risk from hæmorrhage to which the woman is subjected. Under such exceptional circumstances, it is quite possible that no rupture of the original sac may occur. The fœtus will then be retained without the occurrence either of hæmorrhage or peritoneal inflammation, but ultimately its remains will most likely be extruded by a similar process, and through the same channels as in the cases above mentioned. In some remarkable instances, the irritation caused by the presence of a dead fœtus has been so inconsiderable as to permit of its residence for many years within the abdominal cavity, without causing any alarming symptom. It is probably in such cases that the putrefactive process undergoes the peculiar modifications which are manifested either by a withering or mummification of the fœtus, and the subsequent formation of what is sometimes called a Lithopædion, or by a change which seems to be closely allied to *adipocere*. In many of the recorded cases in which the fœtus has been retained for an unusually long period, the sac would appear to have become the seat of calcareous deposit, which, by thickening and strengthening its walls, may be supposed at once to protect the fœtus from external violence, and, at the same time, to protect maternal viscera, by rendering its rupture practically all but impossible. Burns mentions a case in which he had known the fœtus retained for twenty years, and there have been instances in which it has been retained for a much longer period. Women, in some of these cases, have repeatedly become pregnant, and have been delivered of healthy children at the full time without disturbing the retained ovum.

Treatment.—In regard to the treatment of extra-uterine pregnancy, much must in every case depend on the stage of development and on the other circumstances of the case. In so far as the early weeks are concerned, it is obvious that, accurate diagnosis being impossible, treatment can only be palliative, or directed against symptoms the import of which we can only guess at. At a stage somewhat more advanced, precision in diagnosis is scarcely more easy; although, could we only be certain of this, we cannot doubt that the resources of modern surgery might avail. If the sac were lodged in the pelvis, interference would very probably take place with the functions of the bladder and rectum, requiring close attention to the state of the bowels, and perhaps frequent mechanical aid for the relief of the bladder. The attacks of pain, which are of such frequent occurrence in all the forms, will be most certainly and satisfactorily removed by anodyne applications and by opiate suppositories or enemata, strict rest in the recumbent posture being at the same time enjoined, with careful attention to the digestive and other functions.

Destroying the Life of the Fœtus.—The favourable results which follow the death of the fœtus before rupture of the sac have long been held as pointing significantly to the propriety of attempting to destroy its life by some process involving as little danger as possible to the mother. Cazeaux suggested bleeding to syncope or electric shocks, and although the first of these methods is not likely to find favour, it is otherwise with the second, seeing that of late years a number of such cases have been reported, chiefly in America, in which the Faradaic current has been successfully employed. Another method which has been practised is evacuation of the liquor amnii by means of the aspirator, sometimes with a favourable result, but in other instances without benefit, as the removal of a portion of the fluid does not necessarily destroy the life of the fœtus. But, besides that, a considerable number of these cases have, in the hands even of the most skilful operators, resulted in the death of the mother as the result of the operation. Joulin suggested the injection of poisonous agents into the amnionic sac (one fifth of a grain of morphia or of sulphate of atropia), and this too has been carried out with successful results.

When the period of expulsive effort arrives, it comes to be a question whether in any case we may interfere with a view to the relief of the patient by immediate delivery. The cases, doubtless, in which operative interference may be resorted to with the greatest prospect of success, are those in which the fœtus is felt through the vagina, and the nature of the case is distinctly made out, while an additional argument in favour of operation will further be afforded by proof of the life of the child. Besides, there is always the chance that the case may be one of those which have been described as *sub-peritoneo-pelvic*. The operation, if resolved upon, consists in an incision through the vaginal walls, and the removal, by forceps or otherwise, of the fœtus.

Gastrotomy.—If the pregnancy be far advanced, and the life of the fœtus is indicated by the usual signs, and if the sac can be reached only through the abdominal walls, it is, of course, possible to anticipate rupture, and to extract, by Gastrotomy and incision of the sac, a living fœtus. In the performance of this operation few obstacles or difficulties would seem to arise. Up till a few years ago operations of this kind were looked upon with great dread, and operators balanced anxiously in their minds the hope of the child's life against what they considered the imminent risk of the mother's death. The early operations were certainly unsuccessful, the chief danger being found to lie in the alarming hæmorrhage which follows the removal of the placenta, besides the risk arising from the fragments which were left behind. It is satisfactory, however, to know that it is now proved by experience that the danger is much less if the placenta be left *in situ*, no attempt being made to dislodge it, while the brilliant achievements of modern abdominal surgery which have followed on the improvements in the operation of ovariotomy give us great and well grounded hope for the future. But there is a still wider aspect of the case in the application of the operation of Gastrotomy or Laparotomy to the cases previously alluded to, where development is not so far advanced. In an early edition of this work the opinion was expressed "that a day may come when, diagnostic skill being more certain, an extra-uterine fœtation may be ligatured and removed with as great a prospect of success as an ovarian cyst." If it be too much to say that the day has now arrived, we are at least warranted in asserting that the operation is shorn of its terrors, that our means of diagnosis are more sure, and that there is beyond all doubt a great future for the operation, with the certain result of many lives to be saved, and much suffering to be prevented. In cases where a living mature child has escaped by rupture of the sac into the abdominal cavity, there is little difficulty, for here the analogy is complete between the case in question and one in which a living child has similarly escaped through a uterine rupture; and, by the operation in these circumstances, the risk to the mother will be little aggravated, while the life of the child may possibly be saved.

In the case of a woman who has carried, for one or more years, an extra-uterine fœtus, which causes her great suffering or which is obviously undermining her general health, the question of operation may also suggest itself, although in a different form. The rule which must here guide us is, in addition to the state of her health, the possibility of reaching the tumour from the vagina; for, unless we were convinced of the existence of adhesions to the anterior or lateral abdominal walls, an operation in this direction would, we conceive, be attended with very considerable risk. But even here we must speak with caution, seeing that the dangers as well as the bugbears of the past are steadily vanishing as science advances.

The duty of the surgeon will, however, in many cases, be confined to carefully watching and cautiously assisting in the separation of the fœtal debris. Should one or more fistulous openings exist in the abdominal walls, the vagina, the perineum, or the rectum, the nature and extent of the cavity of the sac may be carefully explored through them. By the aid of sponge tents, the apertures may be safely distended, and any loose portion removed; care being always taken not to drag rudely such fragments as may be adherent to the walls of the sac, as by doing so, the sac might be ruptured, and peritonitis ensue. If the communication has taken place in the direction of the bladder, it may be necessary to remove them by one of the operations for lithotomy, or by dilatation of the urethra. While the separation of the remains of the fœtus is thus promoted, in any way which experience may suggest to us as consistent with safety, the general health of the woman must be carefully attended to, her strength being sustained by nourishing food and suitable stimulants, while any tendency to hectic or irritative fever must receive its appropriate treatment.

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CHAPTER XII.

ABNORMAL DEVELOPMENT.

Molar Pregnancy.—False Moles: from Vagina: Membranous Dysmenorrhœa: Fibrinous and Hæmorrhagic Casts of Uterus.—True Moles: Fleshy Moles: Hydatidiform Moles; Their Pathology, Diagnosis and Treatment.—Diseases of the Placenta and their Effects.—Missed Labour.—Diseases of the Fœtus.—Intra-uterine Fractures and Amputations: Efforts at Reproduction.—Monsters.

Molar Pregnancy.—There are, in addition to the peculiarities of development already noticed, certain others which deserve special mention in a systematic treatise, but are not unfrequently passed over as of no moment. There is every reason to suppose that these peculiarities have their origin, in a large proportion of instances, in actual disease of the ovum; but, whether this is, or is not, the primary cause of the affections in question, no doubt can, in the present state of pathological knowledge, be admitted as to the frequent coïncidence of disease or degeneration of the ovum, either with arrest of development, or with the transference of developmental energy to structures which are merely subsidiary. The result of this is the occasional expulsion from the uterus of substances, the nature of which it is not always easy to determine, and the origin and pathology of which have often been misunderstood. These substances are generally termed Moles.

It must be made clear, however, from the outset, that all solid matters discharged from the uterus are not moles, properly so called. In other words, all such discharges are not the result of impregnation, —a fact which is of obvious medico-legal importance, and imposes upon us the necessity of drawing a careful distinction between "*true*" and "*false*" moles. The matters which are discharged from the virgin, or which are independent of impregnation, and which might be mistaken for the result of conception, form but few varieties, and constitute what are termed, with questionable propriety, False Moles.

Under this designation may be included bodies, which are composed mainly of the squamous epithelium of the vagina, thrown off in the form of flakes, or tubular casts, and which may either be expelled singly, or form, by their union, masses of greater or less bulk, but seldom of any considerable size. A careful examination of these by the microscope, or even by the eye, will generally obviate the possibility of error; but, as regards the following, the unwary may easily be misled.

It is a fact familiar to every physician, that the most obstinate and intractable form of painful menstruation, or dysmenorrhœa, is the membranous variety, in which the mucous membrane of the uterus is shed at each catamenial period, either in shreds of various size, or in the form of a single mass, forming a complete cast of the uterine cavity. There seems good reason to believe that, in the majority of such instances—more particularly as they occur most frequently in the married state—impregnation is a factor in the case; but it is equally certain that in other instances there is a shedding of the membrane independent of pregnancy. Obviously, therefore, great caution must be exercised in admitting a presumption of pregnancy; but we may be guided in some degree to a correct conclusion by the presence or absence of the early signs of pregnancy. Still, it is not too much to say that we can never be justified in assuming that pregnancy has existed unless we can make out the villi of the chorion, or something equally characteristic of embryonic structure. When unconnected with pregnancy, moreover, there is nothing corresponding to the decidua reflexa, even although the structure, when discharged, presents three openings,—one for each Fallopian tube, and one at the point of connection with the cervix uteri.

A third variety of false mole has been described as occurring under certain conditions of functional derangement of the uterus, more especially when this is accompanied with some form of inflammatory action. In it, the substances expelled are of a fibrinous appearance externally, of a firm consistence, and varying greatly in size, but frequently presenting the form of a cast of the uterine cavity. Most frequently these are composed of blood-clots, which have become condensed and altered in appearance by their decolorization externally. In certain cases, they appear to be composed partly of clot and partly of lymph; while in others, which have been carefully observed, it would appear that a membranous cast has been surrounded by an outer layer of condensed coagulation.[1]

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[1] These formations are fully described and admirably depicted by Dr. A. B. Granville, in his admirable monograph on Abortion and the Diseases of Menstruation. London, 1833.

The True Moles differ from the above essentially in this, that they are in every instance the result of conception, in which, generally, the embryo has been blighted, and yet development of the membranes has progressed with abnormal activity. In the investigation of these cases, it is of importance to remember what Smellie tells us. "Should the embryo die," he says, "(suppose in the first or second month) some days before the ovum is discharged, it will sometimes be entirely dissolved, so that when the secundines are delivered there is nothing more to be seen. In the first month, the embryo is so small and tender that the dissolution will be performed in twelve hours; in the second month, two, three, or four days will suffice for this purpose." If this is the case when the ovum is expelled shortly after the death of the embryo, it need not astonish us that, when it is retained for a considerable period, all trace of embryo has disappeared, while the membranes are so degenerated or metamorphosed that it is only with difficulty that the true nature of the case can be recognised.

Of the highest interest and importance in reference to this subject, and more especially to the question of etiology, are the hæmorrhagic discharges of which the ovum is the seat. In addition to the direct effect, which must spring from the sudden abstraction of blood either from the fœtal or maternal vessels connected with the ovum, the blood which flows from the ruptured vessels very frequently exercises a mechanical influence in the separation of contiguous parts, with the most disastrous results. Blood may thus be interposed by the rupture of the utero-decidual vessels, and so cut off the only maternal supply possible for the early embryo. Or, at a later stage, hæmorrhage from the utero-placental vessels may so engorge the parenchyma of the placenta, as to cause apoplexy of that organ, an affection which we shall have occasion hereafter to mention. Again, the extravasation may take place between the chorion and the decidua reflexa, or even within the amnion, destroying the embryo and giving rise to abortion. Particular attention has been given by Scanzoni to the various forms of apoplexy of the ovum, a subject which is of interest to us at this stage, as a cause not only of death of the embryo, and of abortion, but also of the formation of true moles, when abortion does not at once ensue. His conclusions as to the progress and termination of the hæmorrhage are as follows:—

"1. If the flow of blood is simply from the utero-placental or utero-decidual vessels, and the quantity is inconsiderable, this does not suffice to separate the ovum in the greater part of its circumference, or by mechanical pressure to arrest its further development; so that blood effused between the uterine walls and the decidua, or even between the two layers of the latter, may be either completely or, at least, partially reabsorbed, and the pregnancy may reach its normal termination.

"2. But if the quantity of the effused blood is considerable, the ovum is separated from the uterine walls either entirely or to a great extent, and is compressed by the voluminous coagulum, and more or less flattened : such compression actually causes bursting of the membranes (of which Dubois narrates a case), when abortion is the usual result.

"3. The same is the result when the fœtus dies through rupture of its own vessels and the placental hæmorrhage thus induced. Here also the abortive ovum is expelled, the rapidity with which the abortion occurs depending especially on the occurrence of simultaneous uterine hæmorrhage.

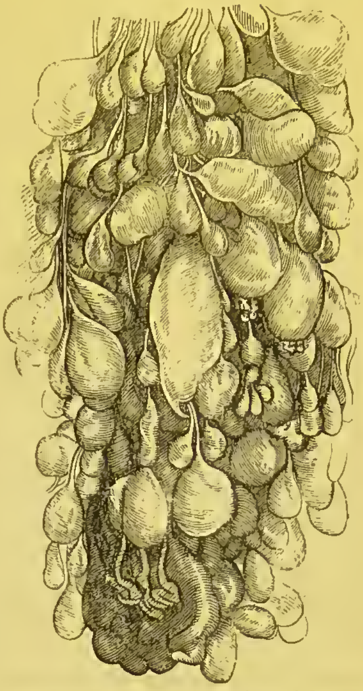
"4. If the ovum, as is much more rarely the case, remain with the dead fœtus for a considerable time in the uterine cavity, the coagulum undergoes certain changes, which are also observable in extravasation in other parts of the body, and so gives occasion for the origin of the formation known under the name of Fleshmole."

The Fleshy Mole (Mola Carnosa) is probably formed in part from coagula, and in part from the membranes of the ovum, which undergo a species of degeneration by some such series of changes as the following :—The effused blood becomes in the first instance decolorized by rupture of the blood corpuscles and absorption of their colouring matter. This decoloration takes place from the centre towards the circumference The fibrin, as Scanzoni supposes, becomes transformed into cellular tissue, by means of which communication is established between the external lining of the ovum on the one hand, and the inner surface of the uterine wall on the other, so that the further development of the structures thus in apposition is rendered possible. We may assume that, in these cases, complete separation of the ovum cannot have taken place, otherwise the death of the whole structures of the ovum would have rendered its expulsion inevitable. And, as the connection between the uterus and the ovum is most firm at that part where the placenta has either formed or is about to form, the probability is that the vascular supply sent to the ovum through this channel is never entirely cut off. On the establishment of new and more extensive adhesions, the blood supply is at once augmented, and the membranes and effused coagula become intimately bound together into a mass, through which vessels freely run, and which becomes hypertrophied to a very considerable extent. It would appear that, at least under certain circumstances, the chief seat of the carneous degeneration is the decidua vera, for it is certain that in many of the cases which have been most carefully examined, the structure of the chorion has been distinctly recognised by its villi, although the membrane itself has undergone some considerable thickening. The villi in these cases have been found to consist of molecular masses and fat cells. The amnion undergoes little change, and may be found adhering to the inner surface of the chorion, and containing within its cavity a certain quantity of bloody fluid, in which will be found what remains of the embryo. The rudiments of the embryo are, however, frequently very indistinct, unless the pregnancy should chance to have been more advanced than usual; and, indeed, difficulty will frequently be experienced in tracing even the remains of the cord, although the chorion and amnion may be tolerably distinct. The nature of the case will nevertheless usually be recognised, on a careful examination, by the discovery of the villi of the chorion, and Scanzoni asserts further that in the cases examined by him he has never failed to discover the enlarged villi by the agency of which the placenta was already going through the earliest stage of its formation. While in all these cases the diseased membranes go on increasing in bulk, they are of course rendered quite unfit for the discharge of their primary functions, so that the contained embryo, if its death has not preceded the degeneration, must speedily succumb. As the development of the mole goes on, it increases in density as well as bulk, and the growth may continue for three or four months, until its presence within the uterus awakens expulsive efforts, when it is speedily expelled, presenting the characteristics just detailed.

Cases occasionally occur in which fatty degeneration is the most conspicuous characteristic of a mole; but this we may merely mention as a variety of the fleshy form; and the same remark may be made in regard to what has been described by German authors as the "*Steinmole*," a variety which seems to attend a retention of the mole within the uterus for an unusually long period, and which implies, as its name indicates, a calcareous degeneration of what had been originally an ordinary fleshy mole. With reference to such cases, it may, however, be remarked that such calcareous masses are to be cautiously received as evidence of mole pregnancy, unless the characteristics of the latter are clearly manifested. For we know that myomatous tumours of the uterus are also subject, although rarely, to a similar degeneration; and it is quite within the bounds of possibility that an error of some magnitude might here be committed, seeing that these concretions are sometimes spontaneously separated from the uterus, and discharged through the vagina.

The Hydatidiform Mole.—The bodies which form the distinguishing feature of these moles were long supposed to be true hydatids, formed in, and discharged from, the uterus. More careful examination showed, however, that they were not, like true hydatids, closed sacs within one another, but that the vesicles were arranged in a manner quite different from this, each saccule growing from another, in regard to which it is either sessile, or connected by a pedicle of varying length. In this manner cyst grows out of cyst, and the pedicles do not unite them with principal stems, but with each other, so that, as Mettenheimer and Barnes have shown, it is incorrect to compare them, with Gooch, to currants, or, with Cruveilhier, to a bunch of grapes. The arrangement is well brought out in the annexed representation of a mass of these bodies which had been expelled from the uterus. The vesicles vary considerably in size, from a walnut downwards, according to the development which they have attained, or the distance at which they are situated from the parent cyst, from which they originally spring. Not unfrequently, when they escape unexpectedly, they are brought under the notice of the practitioner floating in a basin of water, and discoloured with blood; and under these circumstances the graphic description of Gooch is singularly applicable, for they then resemble very closely a mass of "white currants floating in red currant juice."

Fig. 107.



Hydatidiform Degeneration of Ovum.

Although the exact mode in which the vesicles constituting the hydatidiform mole are formed is not yet clearly fixed to the satisfaction of all, there is one point in which all modern authorities are agreed, viz., that they spring from the villi of the chorion. It is also admitted that in this, as in the fleshy mole, we have no new formation, but simply an alteration and degeneration of previously existing structures. But when we come to consider the pathological process by which this alteration is effected, we find that considerable differences of opinion exist. The views on this subject originally propounded by Mettenheimer in 1850, in "Müller's Archiv," and which have been endorsed in this country by Paget and Barnes, are those which are generally entertained. The villi of the chorion, as has been pointed out by modern physiologists, grow normally by a process of gemmation, bud springing from bud in successive stages of growth. Under the influence of perverted development, these buds, or the elementary cells of which each villus is composed, take on a new action, and become transformed into vesicles, which vary in size, and to which attaches the power of repeating the process of chorion development, still in a perverted sense, until the so-called hydatidiform mass is formed. Gierse is of opinion that the change consists in hypertrophy of the normal structures found in the chorion villi, with secondary œdema; and Dr. Graily Hewitt urges that the vesicular transformation is a consequence, and not a cause of the death of the embryo, and that it is therefore nothing more than a degeneration of structures arrested in their development. We fail to see, however, that the death of the embryo, prior to the formation of the cysts, is in any way incompatible with the theory of Mettenheimer; indeed, we cannot but think it extremely probable that in this, as in the case of fleshy moles, it is the developmental force diverted by the death of the embryo into an unwonted channel which is the great cause of the activity of the degenerative process. And, moreover, this is all the more likely to take the form of cystic degeneration on account of the peculiar anatomical conditions under which the villi of the chorion, and more especially those of the placenta, are produced. The period within which hydatidiform degeneration may originate does not probably extend beyond the tenth week, for it is during that period that the activity is greatest in the growth and multiplication of the villi; and, at a later stage, when blood-vessels have largely occupied the bulk of the villi, it would appear that they are no longer capable of undergoing that form of degeneration. A certain dropsical condition, or secondary œdema, as Gierse describes it, of the membranes, is probably an essential part of the degeneration in question, and may serve to account for the constant supply of the fluid which fills the sacs. Although the special activity in the development of the villi which ultimately would have formed the perfect placenta, might naturally be expected to attract thither the morbid action, experience has shown that this is not invariably the case. An important question has arisen as to whether a portion of placenta, retained at the full term, can take on hydatidiform change. This has been answered in the affirmative—among others, by Montgomery and Ramsbotham—but all recent writers dispute the conclusion.

In the majority of cases, an examination conducted with every care shortly after expulsion fails to detect any trace whatever of the embryo, although in some instances a fœtus has been discovered, and this is, doubtless, what has led to the erroneous conclusion referred to. The explanation of the facts as observed is to be found in the fact that, here, growth is limited to the chorion and the degenerated villi, and that the uterus is filled with an enormous mass of cysts which have sprung from this source, so that the cavity of the amnion and its contents are almost inevitably obliterated. The destruction of the embryo is, for this reason, much more complete than in the fleshy variety of mole.

In regard to the *Symptoms* of this form of mole, they are at first identical with the ordinary signs which are supposed, in the first three months, to indicate pregnancy. The usual symptoms, and more especially those which have their seat in the mammæ, then become indistinct and perplexing. The patient is ill at ease, her appetite and digestion become impaired, and her feelings are quite different to those which attended former pregnancies. So soon as the degenerative process has been thoroughly established, the increase in the bulk of the uterus goes on with very unusual rapidity, and it has been noticed to expand irregularly, and more in a lateral than in the usual upward direction. When the period arrives at which the conclusive proofs of pregnancy should, under ordinary circumstances, be distinctly manifested, the absence of fœtal pulsation and ballottement may arouse suspicion as to the nature of the case. But, at a period even earlier, watery and sanguineous discharges, mixed or separately, may occur, the former being due to rupture of the distended vesicles, which have probably been submitted to considerable pressure. It occasionally happens that, along with these discharges, a few vesicles only, or a larger proportion of the mass, escape, which at once reveals the nature of the case. There is, in addition, another symptom to which we would call special attention, and which we have found of the highest importance in practice in the diagnosis of this affection. This consists in a peculiar doughy, boggy feeling, which is revealed on palpation, and which we take to be in the highest degree characteristic, more especially if we take along with it the absence of that irregular hardness which indicates the prominences of the fœtus. The term "dense" which we find generally used to describe the feeling of the uterus in this condition is, although applicable to some cases, as a rule inappropriate. "Tense," again, would represent correctly enough the effect of the rapid distension; but the sensation yielded by palpation, which we have had the opportunity of thoroughly testing in several cases, is, we are persuaded, more correctly described above, than by either of the terms specified.

The existence of moles of this nature is seldom prolonged beyond the sixth month, when repeated hæmorrhage and over-distension of the uterus, entailing probably a partial separation of the placenta, will usually have excited uterine contraction. The effect of these contractions, when once thoroughly aroused, is to effect the complete separation of the entire ovum, which ensures the safety of the woman by the arrest of the hæmorrhage. It would seem, however, that under certain special circumstances, fortunately of rare occurrence, the connection between the uterus and the ovum is so firm that a portion only of the fruit of conception is expelled. "In such cases," says Scanzoni, "portions of the ovum remain behind in the uterine cavity for a considerable time, on account of their firmer connection with the inner wall of the uterus. These may give rise to profuse and long continued floodings, as we have seen in one of our cases occurring in the gynæcological clinique at Prague, where an exhausting hæmorrhage, which had continued for some months after the expulsion of a vesicular mole, was first arrested on the removal by the hand of the remainder of the ovum, which had been retained in the cavity of the uterus."

What is, however, of more frequent occurrence, when the whole of the ovum is not at once expelled, is that the case turns out to be one of twin pregnancy, in which the membranes of one embryo only have become the seat of the degeneration in question. Generally, under such circumstances, the uterus, after expelling a large hydatidiform mass, will not cease in its efforts until the whole of its contents have been expelled, but a certain number of cases have been recorded, in which, after such an event, a fully developed child has been expelled after an interval of a few months, a fact which is only reconcilable with the idea above expressed. This is said by Montgomery to have occurred at the birth of the celebrated anatomist Béclard. The most recent observations on this subject seem to indicate that examples of this nature are by no means of unfrequent occurrence, which obviously shows that we should exercise caution in the treatment of such cases, lest we destroy the living germ while removing the dead.

The *Treatment* of all such cases will of course depend on the urgency of the symptoms. So long as they are moderate in severity, and are not such as to call for immediate action, our course of treatment must be purely expectant, more especially as there will almost always be an element of doubt in the diagnosis. But, so soon as profuse watery and hæmorrhagic discharges indicate serious danger to the woman, we must not delay until interference is a mere *dernier ressort*, but act promptly, and in the manner most likely to empty the uterus speedily of its contents. In cases of hydatidiform mole, we have found the ergot of rye act quite satisfactorily, and effect expulsion without difficulty; as, indeed, it usually does when the uterus has reached a certain degree of distension. We recommend, therefore, that in the first instance, this drug should be employed; but if, as often happens, it fails to excite uterine effort, we must then resort to other means. A sound or catheter has been introduced into the womb, and successfully used so as to break up the mass, and separate it as far as possible from its uterine attachments; but we regard it a safer as well as a more satisfactory method, to dilate the os and cervix by means of Barnes' bags or other similar appliances, so as to introduce the hand, and remove at once the whole mass. The dilatation of the os and cervix by means of sponge tents would also have the effect of exciting the uterus to contraction, and would have the further advantage of checking hæmorrhage. Galvanism has also been recommended; the object, of course, in each and all of these modes of procedure, being to empty the uterus safely as well as quickly. Nothing special need be said in reference to the treatment of the fleshy mole, as in that case the diagnosis is much more difficult. Although the unexpected arrest of development, and the general constitutional disturbance, with the cessation of such of the signs of pregnancy as may previously have been present, may indicate the probability of this affection, it is seldom that its nature is recognised until the carneous mass, with the blighted ovum, has been expelled.

Diseases of the Placenta.—There is yet another group of cases in which the pathological phenomena are also to be found in a portion of the ovum, but which occur at a later period of pregnancy than those which we have just been considering. In these instances, development goes on uninterruptedly until the placenta has been fully formed; and it is to diseases of that organ that the death of the fœtus is then due. Among the affections of the placenta which may have this result, is *Apoplexy of the Placenta*, in which blood is effused, by rupture of vessels, into the parenchyma of the organ, exactly as takes place in the lung, and with a similar result as regards the respiratory function. Another affection which, as we have already seen, is apt to attack the tissue of the fleshy mole, is *Fatty Degeneration*. Recent researches show that, at a more advanced period of gestation, the same pathological change is apt to invade the tissue of the placenta, and so to alter its structure as to interfere seriously with, and ultimately to arrest, the development of the embryo. The cause of this fatty degeneration has been very carefully investigated by Barnes, Priestley, and others; and the conclusion at which they seem to have arrived is, that the fatty molecules are the result of a low form of placentitis,—being either thrown out, primarily, as inflammatory exudations, or formed, secondarily, of inflammatory products which subsequently degenerate into fat particles. *Placentitis* is another affection which may cause intra-uterine death,—the inflammatory process, in these instances, attacking the organ, and in extreme cases leading to hepatization, induration, abscess, and the other terminations of the inflammatory state. The morbid action is generally confined to a limited portion of the organ, or to a few lobules, and extends from the maternal towards the fœtal surface of the placenta. There is reason to believe that morbid adhesion of the placenta may have its origin in placentitis; and, in connection with it, hypertrophy of the decidua serotina has not unfrequently been observed. General œdema, or dropsy of the placenta, is another affection of the organ which has been carefully observed by Meckel and Gierse. The appearances are here altered to those which are characteristic of œdema in all soft tissues,—swelling, paleness in colour, and serous infiltration, being the leading features which an examination of the tissue reveals. "This must not," as Simpson well remarks, "be confounded with the white, blanched, and merely anæmic state of the placenta, often observable in cases where the child has died of peritonitis, or other fœtal diseases, and been retained in utero for some time subsequently; and it is pathologically very different also from the stearoid or fatty degeneration."

Hypertrophy of the Placenta, Cartilaginous and *Calcareous Degeneration, Ramollissement,* and *Atrophy,* are all affections which have been specially observed. In many of the affections above enumerated, there seems to be a tendency to return in subsequent pregnancies; and it may be held as an established fact, that such has been the case in many of those instances of repeated abortion which cause so much disappointment to the mother. Under the influence of these degenerations, the nutrition of the placenta may, for a time, go on uninterruptedly. Soon, however, its function is interfered with, and the safety of the fœtus becomes compromised. The general rule, in such circumstances, undoubtedly is, that the uterus is excited by the foreign body to active contraction, and abortion is the result. But, in a certain number of instances, the diseased vitality of the placenta is maintained, while the embryo becomes shrivelled and attenuated to an extraordinary degree—under which conditions it may be retained until the full term of gestation is reached, and then discharged. This latter result is more likely to occur in twin than in single pregnancies,—the placenta of the one fœtus being diseased, and the other remaining healthy; and it is probably under such circumstances that, with a fully-formed child, a shrunken fœtus is sometimes expelled—giving rise, erroneously, to the idea of superfœtation. The dead fœtus, in those instances, is generally flattened by the pressure which is exercised upon it by the other in the course of its development.

An extremely rare and curious phenomenon has been occasionally observed, in which, the fœtus remaining in utero, labour does not come on at the usual time, and the remains of the fœtus may be retained for a considerable period, or discharged piecemeal by the vagina, without, for a time at least, seriously affecting the health of the mother. This has been called *Missed Labour*, and is alluded to by Dr. Tyler Smith in his admirable Manual, in which he gives the history and illustration of a case which occurred in the experience of Dr. Oldham.

The Umbilical Cord may also, like the placenta, be the seat of certain anomalies, or morbid affections, which may cause the untimely death of the fœtus. Under the former class, may be ranged cases of true knots on the cord, and twisting of it round various parts of the child, which may possibly be attended with fatal results; and, under the latter, may be mentioned inflammation of the cord, or of any of its parts, and cystic degeneration, which was first described by Ruysch, and has been mentioned by subsequent writers, although it is probably of very rare occurrence.

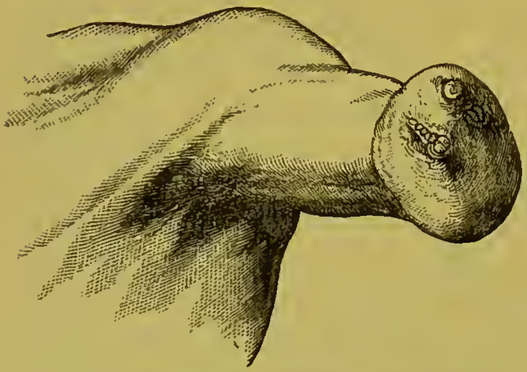
Diseases of the Fœtus.—Having now considered the chief morbid conditions which affect the various parts of the ovum, including the placenta, we may at this place advert, with propriety, to certain diseases to which the fœtus itself is liable. With few exceptions, the fœtus may be said to be subject to the same diseases as are observed after birth. Among the most frequent are the affections of the nervous centres which are due to hæmorrhage, and those which consist primarily in inflammatory affections, from which spring secondary effects attended with very serious results to the mother as well as to the child. Hæmorrhages into the substance of the fœtal brain are very rare; but it is not so much so in regard to discharges which take place behind the membranes or on the surface of the brain. These affections when observed, and when unconnected with obstructed delivery, have usually been found associated with placental apoplexy or obstruction of the cord. Of all the results of inflammatory action in this situation, the most familiar is chronic hydrocephalus, in which the quantity of serum effused within the cranium is often so great as not only to cause a certain amount of atrophy of the encephalon, but also an increase in the size of the head, so considerable as to form a serious obstacle to delivery. Convulsions may attack the fœtus while it is yet in the womb, and cases have been observed in which convulsions on the part of the mother were communicated to the child. The probable cause of these, in most instances, is arrest of the circulation, which causes the fœtus to die of apnœa—of which convulsive action is a frequent symptom. Although the lungs are as yet of very small size, it would appear that they are occasionally, though very rarely, the seat of inflammation; but pleurisy and tuberculosis are of much more frequent occurrence than pneumonia. Acute and chronic peritonitis, whether general or partial in extent, is met with much oftener than the above. This affection may be accompanied by effusions, which are identical in appearance and general characteristics with those which are so frequently observed after birth; and, according to the type of the inflammatory action, they may take the form, either of coagulable lymph, by means of which the viscera may be glued together, or of a fluid effusion, the quantity of which may become enormous, and may cause the death of the fœtus either before or after birth, or may even render delivery difficult. It would appear from certain researches made by Simpson in reference to this affection, that it is not unfrequently associated with syphilitic disease of the mother. Diseases of the liver and of the spleen, many of them associated with the same constitutional disorder, have also been frequently observed; and, more rarely, affections of the alimentary canal, with which may be classed cases of Ascarides and Tænia, these entozoa having been repeatedly found in the intestines of the unborn. Congestion, hydronephrosis, cystic degeneration, and other affections of the kidney, as well as various affections of the ureter, have occasionally been noticed; and the same may be said with reference to cardiac diseases, examples of which, including peri- and endo-carditis, have also been noted. Various diseases of the skin are observed in children born either prematurely or at the full time, including the characteristic eruption of certain febrile diseases, such as variola, which may be contracted from the mother within the uterus, or, what is much more wonderful, which may be communicated through the mother to the child, she herself remaining unaffected. Erythema, pemphigus, and other forms of skin disease, are very frequently to be received as evidence of the existence of syphilitic disease, in one parent or in both.

Fracture of the bones of the fœtus is an affection which is usually the result of violence from without; but a sufficient number of cases have been observed to establish the fact that, independently of any such accident, intra-uterine fracture may occur. Some of the recorded instances of this are of the most extraordinary nature. Chaussier, for example, tells us of one case in which there were forty-three, and another in which there were no fewer than one hundred and thirteen fractures of the bones of the fœtus, facts which it is difficult to understand, unless under the supposition that extensive disease of the bones existed.

Intra-Uterine Amputation.—But a more extraordinary phenomenon still is the occurrence within the womb of spontaneous amputation.

Haller, and many physiologists after him, supposed that these were cases of simple arrested development, but that this cannot be the case in every instance is proved by the discovery within the uterus of the missing part. The fact of this spontaneous amputation having, at a more advanced period, been clearly established by irrefragable evidence, the question which next presented itself for solution was the manner in which such a separation within the uterus could by any possibility take place. To this, the reply given by Chaussier, Billard, and other writers of that period, was that the only manner in which it could be accounted for was to suppose that the parts separated had been the seat of gangrene, and that spontaneous amputation had taken place at the line of demarcation between the living and dead tissue. The discovery in several cases of the amputated part, which had not undergone any decomposition, soon proved that this theory was quite erroneous, and it is to Montgomery that we owe what is now generally believed to be the correct explanation of what was long a pathological problem. Montgomery's view, which has, since he wrote, received the most ample confirmation, was that the intra-uterine section was effected, either by constriction exercised by the cord, or by special bands consisting originally of organized lymph, such as is usually elaborated under the influence of inflammatory action. These bands or threads having become fixed round a limb, their compressive power becomes daily augmented, on the one hand, by their own contractions, and, on the other, by the growth of the body within their grasp. In the majority of cases, the complete separation of the limb is not effected, and it is only partially divided. But, if the processes of contraction and growth continue, the supply of blood to the distal part of the limb is first diminished and then cut off; and, ultimately, the nutrition of the bone being similarly interfered with, it becomes brittle, and probably breaks off short at the point of constriction. A most interesting observation, which we owe to Simpson, in connection with this subject, is the occurrence in these instances of an attempt on the part of nature to remedy the deficiency by a process of reproduction which is familiar low in the animal scale, but of which, as we ascend, nature avails herself less and less. When, in a case of this kind, as he shows by reference to a considerable number of cases, separation *in utero* occurs, a stump is found which offers certain peculiarities in appearance. "Two points of the skin, or rather of the subcutaneous tissue, are found adherent to the end of the ulna and radius, and present a depressed or umbilicated form, particularly when the forearm is flexed and moved, and the fissures of the skin run in converging lines to these two points as centres. Midway, and a little in front of these two points, the rudiment of the regenerated extremity is situated in the form of a raised cutaneous fold, or fleshy mass, or tubercle, and having on its surface one, two, or more smaller projections or nodules, furnished with minute nails." In illustration of this, the appended engraving is given, representing the stump of the left[1] forearm of a fœtus of the seventh month, preserved in the Obstetric Museum of the University of Edinburgh. There are five small rudimentary fingers tipped with minute nails, in the usual position on the end of the stump.

Fig. 108.



Intra-uterine Amputation and attempted Reproduction.

Monsters.—Deviations from the ordinary process of development frequently give rise to results which constitute Monstrosities. The subject of monsters, however, although it might fairly enough be discussed here, is one of such magnitude that we must needs pass it by, as it is quite impossible to give to it even the briefest notice in a work such as this. Those who would pursue the subject may refer to the magnificent *Traité de Tératologie* by Geoffroy St. Hilaire, and to other works where the subject is fully and exhaustively treated. The Anencephalic, Cyclocephalic, and other varieties which consist in the absence of portions of the cranium and subjacent parts, are interesting chiefly, from a purely practical point of view, as being likely to puzzle any one who, on making a digital examination during labour, might chance to touch such a formation. Double monsters are, as we shall see, interesting in their practical bearing, as being certain to be attended with difficult labour, but, as a whole, the subject of monstrosities and malformations is here quite beyond our grasp.

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[1] It is somewhat remarkable that this accident generally occurs on the *left* side.

CHAPTER XIII.

DISEASES OF PREGNANCY.

I. Disorders of the Digestive Functions.—*Excessive vomiting: treatment of: question of Induction of Premature Labour in.—Anorexia—Gastrodynia—Pyrosis—Constipation—Diarrhœa.*—II. Disorders of Respiration.—*Dyspnœa—Cough.*—III. Disorders of the Circulation.—*Condition of the Blood in Pregnancy: diminution of Red Corpuscles: proportional alteration in Fibrin and Albumen. — Supposed resemblance of the Phenomena of Pregnancy to those of Chlorosis.—Administration of Iron in Pregnancy.—Plethora.—Varicose Veins.—Hæmorrhoids.—Thrombus of the Vagina.*

Many of the symptoms which have already been detailed as indicative of pregnancy are such as, under ordinary circumstances, would be regarded as pathological phenomena, and would be classed as Diseases or at least as Disorders. But, under the special circumstances attending the pregnant state, which implies the development of a function purely physiological, these symptoms, which are in a great measure the result of sympathetic or reflex irritation, are naturally looked upon as physiological indications of a natural process. So long, at least, as they are confined within moderate limits, it is usual either to treat them by means of mild palliative measures, or to disregard them altogether, provided the general health does not seem to be in any serious degree affected. A very small amount of practical experience suffices to show that great differences exist, consistently with a perfectly healthy pregnancy, in the gravity of the symptoms which are manifested; a woman, in one case, being scarcely exposed, during the whole period of her pregnancy, even to discomfort; while, in another, with an equally happy result, disagreeable symptoms of one kind or another have been well-nigh incessant. The difficulty, therefore, is where to draw the line, and to determine what cases demand treatment, and in what others interference is to be avoided. These remarks apply especially to the abnormal digestive phenomena which so invariably attend pregnancy, and to certain other symptoms which may be referred to the same category. There are, as is well known, many other symptoms, which are exceptionally attendant on gestation, and which, when present, are essentially pathological from the first. The whole subject, therefore, of the diseases of pregnancy, is one to which careful attention should be given; by the student, in the first instance, that he may be able to appreciate the significance of the symptoms which he may observe; and, by the practitioner, that he may be able, in case of need, so to manage a pregnancy with prudence as to avert such dangers as may be foreseen and avoided. There is good reason to believe that a sound knowledge of the morbid phenomena of pregnancy may enable us not only to avert dangers the nature of which is now well understood, but to discover, in the future, means whereby the dangers and diseases of development may be combated, by agents not yet at our command, and the risks of childbed be thus lessened both to mother and child.

A study, however superficial, of diseases of the womb, or of menstrual derangements, shows clearly that a sympathy, of a very intimate kind, exists between the uterus and the nervous and digestive systems; a sympathy which a knowledge of the origin and distribution of the par vagum and sympathetic nerves might already have led us to expect. We cannot wonder, then, that, during pregnancy, when the function of the uterus is so exalted, this sympathetic action should also be exaggerated. The symptoms manifested are infinite in their variety, according to the constitution of the individual; but so deceptive and erratic are they in their mode of development, that we can place no dependence on them as a guide to the probable progress of a given case. There are instances, and these by no means unfrequent, in which the constitution is actually improved by the occurrence of pregnancy; and cases are even observed in which the downward course of lingering and wasting disease is arrested by conception, and is held in abeyance during its continuance. There are, on the other hand, extreme cases, in which the life of the woman is actually in danger, not from any acute or organic disease, but from the great functional disturbance which, in these peculiar instances, pregnancy provokes. The time at which such symptoms as merit the name of pathological phenomena manifest themselves varies very considerably. Some have their origin in the early months, and such will usually be found, on careful examination, to be purely sympathetic; while those, on the other hand, which do not call for attention and treatment till towards the end of the term of gestation, will be found, as a rule, to be due to some pressure, or mechanical interference with the functions which are disturbed.

Most modern writers, in considering systematically the disorders of the pregnant state, have adopted either the classification of Désormeaux, or some modification of it. Following their example, we propose to divide the affections in question into the following groups :—

1. Disorders of the Digestive Functions.
2. Disorders of Respiration.
3. Disorders of the Circulatory System.
4. Disorders of the Secretions and Excretions.
5. Disorders affecting Locomotion.
6. Disorders affecting the Nervous System.
7. Displacements of the Gravid Uterus.

Disorders of the Digestive Functions.—Vomiting, or rather "*Morning Sickness*," is, as has already been stated, one of the most constant, as it is one of the earliest, of the signs of pregnancy. Indeed, it may be said that, owing to the intimate sympathy which has been spoken of as existing between the uterus on the one hand and the stomach on the other, almost all pregnant women are affected with it more or less. Sometimes, this symptom manifests itself almost immediately after conception—almost always in the course of a few weeks—and it generally continues till the period of quickening has been reached. So long as the vomiting is moderate, it is best not to interfere; and, indeed, an impression very generally prevails, to which Puzos and others have given expression, that it is a salutary symptom, and midwives have an aphorism that "a sick pregnancy is a safe one." But, in some cases, the sickness goes to a very great extent, the woman being constantly nauseated, and the stomach rejecting almost everything, solid or fluid, which it receives. In some of the worst of these cases, it is a matter of constant astonishment how it is possible for the vital powers to be sustained; as everything seems to be ejected almost as soon as it is swallowed. Of course, in all such, a certain portion of the food must be retained, or the stomach rapidly absorbs a portion before its contents are voided. As a rule, the symptom is most violent, and most frequently calls for treatment in the case of primiparæ; but it occasionally happens that a woman, who has previously been pregnant without any very marked digestive disorder, may, on a subsequent occasion, undergo the misery of this affection to the fullest extent. There exists, moreover, a great variety in the amount of pain or discomfort to which the act of vomiting gives rise—some women simply emptying the stomach, without pain or effort, as in the vomiting which is symptomatic of brain disease, while others suffer pain and exhaustion from the excessive retching, to an extent which leads us to marvel how it is possible, under such continued spasmodic action, for the uterus to remain quiescent, and to retain its contents. Even in the extreme cases, the emaciation is by no means in proportion to the severity of the symptoms, and the development of the fœtus goes on as steadily as if the system were quite unaffected by any disturbing influence.

Treatment of Vomiting.—In the cases which are most intractable, the matters ejected are often mixed with bile, the breath is fœtid, and the patient complains of severe epigastric pain. The latter has been relieved by the application of a small blister to the epigastrium, which may be dressed with morphia. The experience of all, however, who have tried opiates seems to be against their use, at least by the mouth. Sometimes, quite suddenly, and without any treatment whatever, the symptoms cease, after having attained their maximum of intensity; but, in other cases, they persist and, if not relieved, reduce the woman to the last stage of exhaustion, when nature at last interferes for her relief by the occurrence of spontaneous abortion—a fact which has been generally received as an indication of the treatment which we should adopt in extreme cases. There is scarcely any form of rational treatment which has not been tried, with a view to the alleviation of this distressing symptom. We shall only mention here, however, such remedies as have been commended by the best authorities, or have seemed to us to be the most reliable. Narcotics, as a rule, are worse than useless, if we except chloral hydrate, which has sometimes given good results when given by enema. When the symptoms are slight and confined to a simple aggravation of the ordinary morning sickness—under which some women are vastly more impatient than others—the remedies employed should be of the mildest possible nature, and in many cases some bitter infusion, or a cup of strong tea before rising in the morning has quite a decided effect. In many instances, we have known the nausea to be greatly relieved, and the vomiting entirely checked by breakfasting in bed, and not rising for some little time afterwards. In some, food is only retained when cold, while, in others, nothing will lie on the stomach but what is hot. Ice will sometimes check it; and bismuth in doses of eight or ten grains, has been said by Cazeaux to have a good effect. It will be obvious from these facts that the management of the diet is an important part of treatment, but one which will often perplex us sadly.

The strictest attention must be paid to the state of the bowels, and marked benefit is often derived, in cases where they are sluggish in their action, from a gentle dose of some mild saline laxative. There is, perhaps, no class of remedies which is attended with such beneficial results as effervescing draughts, among the best of which may be mentioned the granular effervescing citrate of magnesia. On the Continent a favourite remedy is the "potion de Rivière," which is prepared and given in the following manner, so that the effervescence actually occurs within the stomach: —

℞ 1. Acid. Citric., gr. xxxvi.
Syr. Simp. ℥ i.
Aquæ, . . ℥ ii. S.

2. Potass. bicarb., gr. xxxvi.
Aquæ, . . ℥ iii. S.

Sig. A table-spoonful of each to be taken successively.

Calumba and soda is a favourite combination with some; and hydrocyanic acid, or creasote, may be tried, although their usual effect is not to be depended upon. Salicine has also been mentioned; and the salts of cerium were used and strongly recommended by Simpson, but in so far as our experience goes, with no better effect than the other means which have been mentioned. Should there be much exhaustion of the patient's strength, stimulants must be employed; and, indeed, these, when taken in moderate quantities, and in an effervescing form, such as champagne, or brandy and soda-water, seem almost to exercise a specific influence. In some cases, pepsine is a very valuable addition to other modes of treatment, while some strongly recommend the use of ingluvin in doses of from three to ten grains. Sometimes, when such of the above measures as may have been selected are totally devoid of effect, we stumble fortunately on some agent which may chance to have the desired effect, even though it be of the simplest possible character. Of such a nature is milk and lime-water, and barley-water; indeed, in reference to the latter, we have seen such striking instances of its efficacy, in which it has been retained by the stomach when all else has been rejected, that we have come to look upon it as among the most valuable agents which we have at command. Lumbar pain is sometimes associated with the vomiting of pregnancy, and it is possible that this may depend upon that slight form of uterine inflammation to which Burns refers as a cause of obstinate vomiting. A beneficial effect is also derived from the use of belladonna, applied either to the abdomen, as recommended by Bretonneau, or administered in the form of pessaries. In some cases, where the irritability of the stomach seems merely to be increased by food and drink, it will be proper for us to sustain the powers of nature by nutritive enemata; and, availing ourselves, further, of the possibility of ingestion by the skin, we may give warm baths, to which gelatinous matter, in any form, may be added; or inunction, by means of cod liver, or other oil, may be practised.

Dr. Graily Hewitt has attempted to establish, as a part of his system of uterine pathology, that the vomiting of pregnancy is due to displacements, and is to be controlled by appropriate mechanical support, but his extreme views on this subject are not likely to command much support, although no one doubts that displacement may occasionally be the sole cause. Another method of treatment of comparatively recent origin is dilatation of the os by the introduction of the finger, and although one would naturally fear that such a procedure might become the cause of abortion, a sufficient number of cases have been recorded to show that the sudden cessation of vomiting after dilatation is often very striking.[1]

Failing all other means, the question remains whether we are warranted in imitating what nature occasionally effects by her own efforts, by inducing the *Premature Expulsion of the Fœtus.* We shall not pause here to consider, as some have done at great length, the moral aspects of this important practical question. The idea involved is death to the fœtus, in order either to avoid risk to the mother, or to save her life, when that is in immediate and urgent danger; and no right-minded man can decide in such a case, without feeling that a grave moral responsibility rests upon his decision. We apprehend that when it is a mere question of freeing the woman from the risk of a contingent though not imminent danger, we are in no case warranted in sacrificing the life of the child, and we must therefore dissent from the conclusions of those who would sanction such a proceeding in any condition of the mother short of extreme peril. The conclusion at which Cazeaux and others have arrived is, that under no circumstances are we justified in inducing premature labour for the relief of the vomiting of pregnancy, but to this we cannot assent, although we admit that the cases which would warrant the operation are of extremely rare occurrence. That such cases do occur we cannot doubt; but let the young practitioner be assured that a life-long experience will scarcely bring such a case under his observation, and let him beware, therefore, lest by exaggerating to himself the importance of the symptoms, he may, in his anxiety, be led into error. For his guidance, we would call attention to the following facts:—

1. Cases have been recorded in which death has undoubtedly been the result of vomiting during pregnancy, and of the inanition consequent upon it. Two examples of this are narrated by M. Dance, in the

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[1] For details as to this procedure, see a paper by Dr. Edward Copeman: British Medical Journal, May 15, 1875.

Archives Générales for 1827, where the vomiting began with pregnancy and terminated fatally,—in the one case at three, and in the other at three and a half months. Dubois met with twenty fatal instances in thirteen years, and Tyler Smith alludes to two cases "in which the induction of premature labour artificially was so long delayed that the patient died before abortion could be induced." Burns, on the other hand, says "that he has never known vomiting, purely dependent on pregnancy, end fatally;" and a similar observation is made by Désormeaux.

2. Numerous cases are recorded in which the operation was successfully performed, with immediate relief of the symptoms. Such instances, however, while they afford proof of the safety of the operation, are not to be admitted as, in any sense, arguments in favour of the practice; moreover, the result alluded to is far from being invariable.

3. Instances have occurred, in the experience of almost every practitioner, in which the symptoms, although of great severity, spontaneously ceased, and the labour reached a happy termination; and not a few are recorded, on excellent authority, which show that, at the last moment, and in the most desperate case, the vomiting may cease, and an equally satisfactory result ensue. In illustration of this, we may cite the following example, which occurred in the practice of Dubois:—

> "A young German lady, two and a half months pregnant, had vomited almost incessantly from the first fortnight of her pregnancy. For six weeks she vomited every few minutes, and the smallest spoonful of fluid set up at once the most energetic contractions of the stomach. She was excessively emaciated and feeble: her breath was very fœtid. In a word, the symptoms were so grave that M. Dubois called in Chomel. The prognosis of both was almost hopeless, and they left the lady, in the belief that she had but a few days to live. Two days after the consultation, the patient was seized with severe diarrhœa, and from that moment the vomiting ceased, and never returned. She could then take and retain some nourishment, the quantity of which was gradually increased until she regained her strength and full digestive powers."

This woman, then, after being so near death that two such men considered it a hopeless case, made a perfect recovery, and carried her child to the full term. Dubois gives, quite frankly, the details of two similar cases, in which he proposed abortion. In both, the women refused, and went to the full term.

A review of facts such as these should certainly lead us to use the greatest possible caution, when the question of premature labour comes, in such cases, under our consideration. It is unfortunate that the great majority occur in the early months of pregnancy,—a fact which increases our responsibility. For, if it were essentially a disease of the last, instead of the first weeks, we might provoke labour with less hesitation, as we would then have a viable child, instead of an embryo whose expulsion involves its death. The special circumstances which attend each case should be taken anxiously into consideration, and we should certainly say that, seeing that dilatation of the os and cervix may be made the first stage in an operation for causing abortion, we should, even in the most extreme case, always pause at that stage, and only proceed to what involves inevitable abortion when dilatation alone has failed.

Among the other disorders of digestion to which pregnancy gives rise, *Anorexia* is sometimes prominent. The lack of appetite, amounting occasionally to actual disgust and loathing, is most marked in the early months, although not confined to that period. It is to be met by very careful attention to the normal functions, and by regulation of diet. The effect of tonics, although occasionally good, is not to be depended on; and it must always be remembered, in reference to the treatment of this and other disorders of the same class, that although we may mitigate symptoms and deaden sensibility within certain limits, we cannot annihilate the sympathy upon which the manifestation of these phenomena depends. It is far from unusual for the appetite to become depraved in a manner similar to what occurs in chlorosis; and this, in an aggravated form, constitutes the affection known as Pica. What usually occurs in healthy pregnancy is that the appetite is altered but not depraved, milk, fresh fruits, succulent vegetables, and other articles of diet easy of digestion being the form of "longing" which prevails. But, when this takes a morbid direction, we find the desire for such substances replaced by a craving for raw rice, soap, chalk, cinders, slate pencil, and even substances more disgusting. If the morbid longing be for such matters as may be prejudicial to health, they must of course be withheld, even by forcible means should this be necessary. It is, however, usual, and is certainly judicious, to humour the tastes as far as is possible, as they not unfrequently point to the class of diet which agrees best with the patient.

Gastrodynia and *Pyrosis*, if present in any marked degree, must be treated by precisely the same means which we would adopt in the same affection occurring in other circumstances; and for this purpose bismuth, calumba, and antispasmodics, combined if necessary with minute doses of opium, may be prescribed. In heartburn and acidity, Dinneford's fluid magnesia, or the effervescing citrate or bicarbonate of potash, may be administered in each case with every prospect of at least temporary relief to the symptoms. *Constipation* is a very frequent concomitant of pregnancy, and is due to the pressure which is exercised by the pregnant womb upon the bowel, thus not only reducing its caliber, but also paralyzing to some extent its muscular fibres. In other cases, there is a want of bile, and they who hold that there is during pregnancy a pseudo-anæmic state of the system, attribute the irregularity of the bowels to the same causes which operate in the early stage of chlorosis. In any case, whatever the cause may be, constipation is of constant occurrence, and women who were not previously of a costive habit frequently require laxatives during the whole course of their pregnancy. If clay-coloured stools indicate that the function of the liver is interfered with, a few grains of blue pill given occasionally will often do much good. In the opposite condition of diarrhœa, which is by no means unfrequent, we must be careful to discriminate the nature of the case before pushing astringent treatment too far. If it depends upon fæcal accumulation, or upon the presence of irritating matter in the alimentary canal, the first step in the treatment must be to clear out the bowels by castor oil, and then to exhibit, if necessary, such astringents as the nature of the case seems to call for.

The Disorders of Respiration, which accompany pregnancy, are by no means numerous. *Dyspnœa* is an affection which is very common in the later months, and is then due to the mechanical pressure exercised in the direction of the diaphragm by the expanding womb. Rest, careful attention to the digestive functions, and such arrangement of the dress as may tend to encourage thoracic, and relieve diaphragmatic respiration, are the obvious and sole means by which this affection is to be combated. In the last weeks, the falling down of the womb which then occurs, will generally be found, by relieving the diaphragm from pressure, to put an end completely to the discomfort from which the patient suffers. Dyspnœa may, however, exist at any period of pregnancy; and, when it occurs in the earlier months, it is probably due to sympathetic irritation communicated through the nerves. We have known the dyspnœa under these circumstances to be very harassing, and in one instance it was accompanied, during the first five months, by severe spasmodic asthma in the case of a lady who never suffered from that affection either before or since. Antispasmodics are obviously indicated in such a case, and, in the instance in question, great benefit was derived from a combination of chloroform with bromide of potassium. *Cough,* the result apparently of mere sympathetic irritation, is also an accompaniment of pregnancy in no small number of cases. It may be found to be associated with congestion of the base of the lungs, or with some more serious affection of these organs.

As a rule, it exists independently of any ascertainable pulmonary disorder, but is, nevertheless, frequently spasmodic, and at times so violent as to resemble hooping-cough; and in these cases it may induce abortion. Some combination of sedatives and antispasmodics would be the best form of treatment for such a case—the symptoms of which are often specially troublesome during the night—and by promoting sleep, may prevent exhaustion and constitutional disturbance.

Disorders of the Circulatory System.—Careful analyses have been performed in order to determine the condition of the blood during the pregnant state. Among these, the researches of MM. Andral and Gavarret are conspicuous for the care with which they were conducted, and the interest which attaches to the results they disclose. They showed clearly that the plethoric condition of the circulation, which had been believed in by past generations of practitioners (and which was often treated by the ever-ready lancet), did not exist; and not only this, but that the condition which was to be observed in the greater proportion of cases was more of an anæmia than a plethora. The fact is that, as a rule, an examination of the blood of a woman who is pregnant discloses alterations in the relative proportion of its constituents, which are closely analogous to what we may observe in anæmia from any cause. In the earlier months of pregnancy, it would appear that the blood deviates little from the normal standard, that the corpuscles are present in their usual number, and that the fibrin and albumen are scarcely altered in the proportion which they bear to the other constituents. In the later months, however, the blood is characterized by a remarkable diminution in the number of red corpuscles, and a considerable increase in fibrin, while the proportion of albumen is somewhat diminished. It would appear further that, in some cases at least, the proportion of white corpuscles is increased. An estimate has been made by the same observers, according to which they assume that, if we suppose the average number of red corpuscles in the blood of healthy women who are not pregnant to be represented by the number 125, the average in women towards the end of pregnancy is probably not more than 115. If, in like manner, we take 300 as representing the physiological average of the fibrin, the proportion of that constituent up till about the sixth month may be set down at 250, while from this period onwards, during the last three months of gestation, it steadily increases in quantity, and reaches as high in extreme cases as 480. These physiological phenomena accord perfectly with the small clot and the buffy coat which have been so generally observed while practising venesection in the course of a pregnancy, and are further interesting in connection with the occurrence of thrombosis in the pregnant state. The interpretation, however, which was formerly attached to this, was that the appearance was due to an inflammatory condition of the blood, and was consequently evidence that bleeding was rational and judicious; but now, a more correct knowledge of true physiological principles enables us to recognise that such an appearance is simply due to the alterations which have been mentioned. In addition to the facts above noted as the result of analytical research, it has been further established more recently that the quantity of iron, as we would naturally expect from the loss of red corpuscles, is decidedly diminished.

Many of the symptoms of pregnancy, it must be admitted—such as somnolence, weight in the head, flushing, ringing in the ears, and vertigo—bear a striking resemblance to those which indicate plethora. As the lancet has, however, fallen into disuse, it is unnecessary to repeat that such symptoms are no indication whatever for bleeding. There is, indeed, much reason to believe that the errors of a former generation have in this, as in some other respects, led to the absolute rejection of what is a powerful agent in the treatment of disease, and that in avoiding one extreme we have gone to the other. We cannot doubt, however, that in the treatment of the pregnant state the change has had a beneficial result, for with the blood in such a state as it is now demonstrated to be in the later months of pregnancy, no one, even in former times, would have thought of bleeding in an ordinary case of gestation. The analogy between pregnancy and chlorosis is most elaborately argued and worked out by Cazeaux, who goes so far as to assume that the system during pregnancy is in a state closely resembling anæmio-chlorosis, and that the treatment of pregnancy should in a great measure be based on a knowledge of this fact. "An animal diet," he says, "and the administration of chalybeates have for many years seemed to me to be as useful against the functional disorders of pregnancy as against those of chlorosis."

We cannot, however, admit, as Cazeaux seems to do, that an affection identical with chlorosis is a usual and normal condition of pregnancy. To do so would be to admit that a pathological state is the normal accompaniment of a physiological function, a view which we are certainly not prepared to accept. That the phenomena are so far identical has been proved, but there are other explanations which may be offered, more in accordance with such analogies as may be drawn from known physiological and pathological laws. We may, for example, accept it at least as possible that the demand which is, during pregnancy, made upon the mother to supply the material necessary for the rapid development of the infant which she carries, may of itself cause what we are accustomed to consider a deterioration in the constitution of the blood. And yet this so-called deterioration may, for aught we know, be a wise provision of nature against the time when this demand shall suddenly cease. Indeed, although we have little fancy for theories in support of which we have no facts to advance, we do think that it is by no means improbable that the vital engine is, for a special purpose, worked at a low power during the last months of pregnancy. In this way at least, the tendency to post-partum inflammatory action may be diminished, as it is only by degrees, after labour, that the blood regains its normal and healthy composition. Or, again, this pseudo-chlorotic state may be in a great measure induced by inadequate nourishment, the result of the nausea and anorexia which so frequently occur. But, whatever the cause of the alteration of the blood may be, it is very doubtful whether iron can with propriety be administered in most cases of pregnancy. In certain cases in which special circumstances have induced us to prescribe it, we have found that its effect was less satisfactory than usual, and that it did not allay digestive disorders, but rather, from its tendency to increase the sluggish action of the bowels—which is so frequently a complication of pregnancy,—seemed, in some cases at least, to aggravate them.

In thus opposing the view that pregnancy should be treated as a disease, when it presents what we recognise as its normal condition, we must guard ourselves from the possibility of misconception. There are cases, undoubtedly, in which the symptoms are such that we are bound to look upon them as cases of chlorosis; nay, we may go further, and admit that such cases are by no means of very rare occurrence. Circumstances render it highly probable that many of the signs of pregnancy are intimately associated with the diminution of the blood corpuscles already alluded to, but it seems somewhat curious that these symptoms are often present during pregnancy, while the healthy ruddy complexion of the patient discourages the idea of chlorosis. In accounting for this, we must bear in mind, as Scanzoni observes, "that there is a form of chlorosis in non-pregnant women, in which the patients, in spite of the fact that the relative quantity of blood corpuscles has undergone diminution, preserve a quite healthy colour, so that it is conceivable that, in pregnant women also, the pale colour of the general surface is no pathognomonic sign of a diminution of the blood corpuscles." To this we would only add, that it consists with the experience of all that pallor is quite as frequent in the early as in the late months of pregnancy, although in the former case the alteration in the relative proportion of the blood corpuscles is as yet scarcely, if at all, disturbed.

In a certain number of instances, however, the deterioration of the blood takes place at an unusually early period, and, running its course with great rapidity, leaves the woman, before many weeks have passed, in a state in which all the symptoms of chlorosis in its higher grade may be manifested; and those symptoms are all the more marked when the chlorosis has preceded conception. In all such cases, the course of gestation is more or less disturbed by the characteristic symptoms of the disease, and an influence is not unfrequently exercised upon the duration of pregnancy by the occurrence of exceptionally violent symptoms, which may give rise to premature delivery. The experience of those who have devoted most attention to this subject seems to show that no hurtful influence is exercised by chlorosis on the progress of labour, but that a common result is that convalescence is greatly protracted, and that there exists an increased tendency to hæmorrhage. In such cases also, it has been remarked that there is an increased liability to diseases which are the sequelæ of labour, such as Phlegmasia Dolens; and, in the case of epidemic puerperal fever, that disease is apt, when it attacks a chlorotic woman, to assume some one of its more fatal forms. The treatment of the chlorosis of pregnancy is to be conducted on the same principle as under other circumstances. It will thus consist mainly in careful attention to the general health, special attention being given to the diet, which should in all cases be generous, and contain a considerable proportion of animal food. Stimulants in some form are also indicated, the red wines of Bordeaux, Burgundy, and Hungary, being perhaps superior to all others in the treatment of this class of diseases. In this respect, however, tastes as well as constitutions vary considerably, but, as a rule, the milder stimulants will be found to suit better than those of greater alcoholic strength, unless, indeed, sinking, or even collapse, the result, it may be, of some form of hæmorrhage, should call for more energetic measures. The only class of medicines which stand prominently in advance of others in the treatment of chlorosis are of course the various preparations of iron, which should therefore in every case be tried. If the bowels are constipated, the iron should be combined with a laxative; but our own impression is, as has already been observed, that it is, as a rule, less efficacious in pregnancy than under other circumstances.

Many interesting speculations suggest themselves for consideration, in connection with this part of our subject, in consequence of what modern investigation has disclosed with reference to the changes which take place during pregnancy in the *Circulatory System*, to which we may here briefly refer. There is here no reason to doubt that Larcher was correct in assuming that the heart in pregnancy is increased in size and that the increment is chiefly, if not entirely, connected with the left ventricle. Along with this we note that there is a marked increase of arterial tension in which we may recognise, as we shall see afterwards, a probable cause of certain changes in the kidneys and their secretion. In direct connection again with this, may be observed the enlargement of the thyroid gland which has been so frequently recognised; and, putting aside the effect obviously produced on the mammary glands as special in its character, we see that, among the other phenomena of the pregnant state, there is a marked activity in the glandular system generally. How far these varied facts stand to each other in the relation of cause and effect remains yet to be fully disclosed.

Plethora, in its wider sense, is a comparatively rare affection of pregnancy. Local Plethora or congestion is of course common enough, and is the result generally of mechanical pressure, exercised either upon the organs affected or upon venous trunks. A certain number of cases do, however, actually occur in those whose temperament renders them liable to hyperæmia. In those instances, the symptoms of pregnancy are different from such as are ordinarily observed, but are by no means rendered more bearable. In fact, the vertigo, ringing in the ears, flushing, and severe headache greatly aggravate the discomfort of the woman. If these indications are disregarded, and the symptoms unchecked, nature may relieve herself by the spontaneous occurrence of hæmorrhage; and, if the flow of blood should take the direction of the utero-placental or utero-decidual system, a very natural result will be the premature expulsion of the fœtus or embryo. The treatment proper to such cases will consist, in the milder form, of simple regulation of the diet and mild laxatives. We must not here, as in the chlorotic cases, encourage our patient to use animal food with freedom; but, on the contrary, we must enjoin abstinence, complete if need be, from such articles of diet, and even from the milder stimulants—light soups, cooling drinks, and a large share of vegetables being substituted for more stimulating materials. Our object here is to keep the supply in proper balance with the assimilative powers, so as to reduce the tendency to hyperæmia; and our efforts in this direction will be greatly aided by the use of laxatives, of which the salines are the best for the purpose, beginning, perhaps, in the first instance with a more active cathartic. When the symptoms are so severe as to lead us to apprehend serious results, such as convulsions, and there is evidence of a special determination of the blood in any one direction, such as the brain, the kidneys, or the womb, local abstraction of blood by leeches or cupping-glasses may, cautiously, be resorted to. In such cases the bleeding must be followed by the general treatment above indicated, which should be rigorously maintained, it may be continuously, or at such intervals as seem necessary, during the whole course of the pregnancy.

Effects of Pressure.—The pressure which, during the pregnant state, is exercised upon venous trunks, gives rise to a number of symptoms which are thus due to a cause purely mechanical. Among the more common of these is a varicose condition of the veins of the legs and lower part of the trunk, which, when trifling, may be disregarded, but, when severe, should be treated by bandages, the pressure of which must be carefully regulated. Should this condition of the veins have preceded impregnation, the symptoms may be so severe as to suggest to the mind the possibility of relief by some operation with a view to a radical cure. It need scarcely be said, however, that, under the circumstances of pregnancy, the chance of a favourable result from any such operation is extremely doubtful; and moreover, the immediate effect of the operation might be to disturb the progress of gestation. Hæmorrhoids spring from the same mechanical cause as the preceding affection, and are besides very greatly aggravated by the habitual constipation which is of such frequent occurrence during pregnancy. However severe the suffering may be to which they give rise, there are scarcely any circumstances which would warrant us in excising, ligaturing, or otherwise operating with a view to the cure of this troublesome affection. Nor is it proper even to apply leeches to the part, if it be true, as has been asserted, that these may cause abortion; and, besides, Désormeaux tells us that he has never known the application of leeches to, or incision of, these tumours in pregnancy attended with any durable amelioration in the symptoms. The treatment of hæmorrhoids must consist, therefore, in measures which are purely palliative. If they are painful, sponging with warm water, or fomenting with sponges wrung out of hot water and applied successively as hot as can be borne, is often attended with the greatest possible relief and comfort. Of local applications, nothing perhaps is superior to the well known Unguentum Gallæ cum Opio. Where hæmorrhage is a prominent symptom, it may be necessary to employ more active astringents, but what is more useful is cold injections, which may be quite freely used without risk.[1] It is doubtful whether cold hip-baths are advisable, as the risk in that case of exciting uterine action is increased.

Vaginal Thrombus.—We have already observed, as a sign of pregnancy, the distended condition of the small veins of the vagina, which gives rise to an alteration of the colour of the part to a different tint. If the pressure be unusually great, these veins may assume a varicose appearance, but if this only is the result, no interference is necessary, and the inconvenience is but trifling. In another and more severe class of cases, rupture of the distended vessels takes place, and the result is the formation of a livid tumour, usually limited in extent, and situated for the most part in one or other of the labia. This tumour constitutes a Thrombus of the vagina. Its appearance, which is usually sudden, is attended with considerable pain, and its immediate cause, in many instances, is to be traced to blows, falls, or violent efforts of any kind. It is very variable in its course and termination, and may end by resolution like a thrombus in any other situation, in which case it is of very short duration. It may terminate also in rupture, which gives exit to the pent-up blood, and may thus give relief and lead to a speedy cure; or the hæmorrhage may be so excessive as to cause great apprehension, and it has even terminated in death. In other cases, suppuration and gangrene have been the immediate effects, and from the latter process a fatal result has also ensued. The condition of the parts during pregnancy renders this affection more serious than when it is independent of the process of gestation, and it is not until delivery has taken place that we can look for cure. This is, however, by no means always the case, for the relaxation which then occurs facilitates the further effusion of blood, and we may therefore have, immediately after delivery, a serious increase in the bulk of the tumour. For a similar reason, thrombus is occasionally developed for the first time after labour, and in these cases there is more danger of its acquiring a considerable size.

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[1] Cazeaux recommends the administration every night of a full enema, to be given cold, and when this has been evacuated, a second is to be given, about a fourth of the bulk of the first; the second to be retained.

The treatment of vaginal thrombus is a point of great nicety and importance. In those cases in which there seems to be a tendency towards resolution, and in which the density of the tumour becomes increased while its bulk diminishes, no active interference is called for, and our duty is simply to watch the progress of the case, lest circumstances should arise to call for prompt action. In cases, on the other hand, where the tumour is of large size, so as to fill a considerable portion of the pelvis, and form an obstacle to the functions of surrounding parts; or when it is fluctuating throughout, showing that it contains a vast reservoir of fluid blood, and when there is reason to believe that the hæmorrhage into the tissues is still going on; or, again, when there is pointing and other evidence that at any moment spontaneous rupture may occur—and in all these cases evidence that the vital powers are on the wane—we cannot hesitate, but must act by at once incising and giving vent to the effused blood. The two groups of cases above cited are extremes, but there is another, forming probably the largest number of all, which may be supposed to occupy a place intermediate between them. In this class, while the symptoms are neither such as to make us confident in the approach of resolution nor to cast aside as injudicious the idea of further delay, we are constrained to wait, with varying hope and apprehension, as long as the health of the woman will admit of it, until the features of the case become so marked in one direction or another that our course of procedure is definitely fixed. A special class of cases are those in which a thrombus during labour threatens to be an actual impediment to its progress, and in which, for that reason irrespective of others, it may be necessary to operate.

In all cases in which incision has been determined upon, we must in the first place take care to make the aperture a free one, for if a small opening only is made, nothing will escape but fluid blood, and all the clots, which constitute probably the greater portion of the bulk of the tumour, will be left behind. If the clots are adherent, or firmly enclosed in the interstices of the tissues, care must be taken in dislodging them, lest we should unwittingly give rise to fresh hæmorrhage. As regards the point of the tumour at which we are to operate, we must, in the first instance, be guided by the fact whether or not there is any indication of pointing, and, if so, our choice must fall upon the site so indicated. But if there be no pointing, and seeing that the thrombus is very generally situated in the labia, and has thus a cutaneous and a mucous surface, the question arises through which of these is the incision to be made. On this point, most of those who have written on the subject are agreed that to make the opening from the cutaneous side gives the patient the best chance. The freer exit for the discharges, the protection of the wound from the lochial and other irritating fluids, and the improbability of there being in future labours a cicatrix which might again give way, are among the reasons which have been urged in favour of this mode of procedure. The inflammation which usually supervenes upon the operation must be combated by appropriate means, such as strict cleanliness, and suitable lotions and injections. The prognosis of all such cases is far from favourable. "Of sixty-two cases," says M. Deneux, "which have come to my knowledge, the woman died in twenty-two, either during pregnancy, or labour, or afterwards. And, with the exception of one case, all the children of these twenty-two women died."[1]

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[1] Under the head of disorders of the circulatory system may be mentioned a subject which has of late years attracted considerable attention, chiefly on the Continent, viz., the relation which subsists between pregnancy and disease of the heart. See on this subject a singularly able work by Dr. Angus Macdonald, "The Bearings of Chronic Disease of the Heart upon Pregnancy, Parturition, and Childbed." London, Churchill, 1878.

CHAPTER XIV.

DISEASES OF PREGNANCY (CONTINUED).

IV. DISORDERS OF SECRETION AND EXCRETION.—*Ptyalism.—Interference with Function of Kidneys and Bladder.—Retention of Urine: Mechanical or from Paralysis.—Albuminuria: State of the Blood in: Peculiarities of the Puerperal Form: Connection of with Puerperal Convulsions: Symptoms, Prognosis, and Treatment.—The Phosphatic Diathesis in Pregnancy.—Leucorrhœa and Granular Vaginitis.—Ascites.—Dropsy of the Amnion.—Hydrorrhœa.* V. DISORDERS AFFECTING LOCOMOTION.—*Pelvic Articulations: Relaxation of: Inflammation of.* VI. DISORDERS AFFECTING THE NERVOUS SYSTEMS.—*Affections of the Special Senses.—Effect on the Moral and Intellectual Faculties.—Abdominal and Uterine Pain.* VII. DISPLACEMENTS OF THE GRAVID UTERUS.—*Prolapsus.—Anteversion and Anteflexion: Symptoms and Treatment of.—Retroversion; how caused originally: Chronic and Acute forms: Symptoms and Treatment of each: Operation for the Reduction of.—Oblique Displacements.*

IV. *Disorders of Secretion and Excretion.*

PTYALISM, which has already been mentioned as a concomitant of pregnancy, is occasionally excessive, and may thus give rise to such annoyance as to cause the woman to apply for relief. It has generally been observed as an affection of the first weeks of pregnancy only, and rarely lasts more than two months: if it be excessive, or of longer duration than usual, it may be relieved by the use of gum arabic, tamarind water, ice, or some gentle astringent.

The Function of the Kidneys is not, as a rule, in any way disturbed by gestation.[1] It is, however, otherwise as regards the Bladder, which, from its situation, is peculiarly liable to be affected in its function by the pressure to which it is subjected. Annoyance from this source is seldom experienced in the early months of pregnancy, but, in the last weeks, when the uterus has fallen downwards, as is usually the case prior to delivery, the pressure then brought to bear upon the neck of the bladder, which is compressed between the head of the child and the symphysis, may give rise to intolerable annoyance, for the relief of which prompt action is frequently required. In many cases, the woman is able to relieve herself perfectly by placing herself on her knees and elbows, when, the weight of the child being transferred to the fundus of the womb, the mechanical obstacle is at once removed, and she is able to micturate without difficulty. The cases in which the greatest amount of difficulty exists are those which are accompanied by anteflexion of the womb, when the pressure upon the bladder is, for obvious anatomical reasons, more severe. Complete retention of urine is occasionally the result, and, in such a case, the bladder may become enormously distended, and, in an unnaturally elongated form, may reach as high as the umbilicus; and, indeed, cases have been recorded in which death has taken place from rupture of the bladder, and escape of the urine into the peritoneal cavity. Fortunately, however, it is only on rare occasions that the retention is complete, but it is by no means unusual for the practitioner to be summoned to relieve the almost constant irritation from which the woman suffers, in consequence of the difficulty which she experiences in her efforts to empty the bladder. If this difficulty is not relieved by change of posture during the act, an abdominal bandage, carefully adjusted, and worn so as to give support to the uterus, will often be productive of the most satisfactory results. But, failing such means, it will be necessary, in many instances, to use the catheter, and in this manner to relieve the bladder. With the ordinary female catheter, considerable difficulty may often be experienced, as it is too straight and too short to be adapted to the altered anatomical relations of the urethra and bladder; and, indeed, its use is not free from risk. It is, therefore, much better to use an elastic catheter, by means of which the operator will, even in cases of complete retention, rarely fail to effect his purpose. In cases where the compression is comparatively trifling, it may act in another way, by inducing paralysis of the sphincter vesicæ, and a constant escape of the urine drop by drop. In one case, this was observed by Scanzoni as early as the third month, and disappeared entirely so soon as the uterus had risen out of the pelvis in the fourth. Catheterism may be employed as often as is necessary; and the catheter may be left in for several hours, while the woman lies quietly on her back, should the symptoms not yield to the simple emptying of the bladder. Sometimes, in the last months, she experiences a smarting or more severe pain in micturating, which has been found to depend, in many instances, upon a catarrh of the bladder, or at least of its neck; under which circumstances, whitish flakes and purulent matter in the urine will disclose the nature of the case, for the treatment of which, the only safe means which can be adopted are baths, bland drinks, and emollient applications. This affection may be associated with spasm of the neck of the bladder, which may also exist independently of any local disease, the irritation which causes it being sometimes due to pressure, and at other times to a reflex irritation starting from the uterus.

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[1] The formation of Kyestéine has already been referred to.—See *Signs of Pregnancy.*

Albuminuria in Pregnancy.—The existence of Albuminuria as a disease of pregnancy, was first discovered by M. Rayer, and in this country was brought under the notice of the profession by Dr. Lever. Previous to this, there can be no doubt that many cases were set down simply as instances of œdema, due to pressure (the Œdema Gravidarum of the old writers), which were, nevertheless, due to albuminuria or to the changes in the kidneys upon which that symptom usually depends. Under ordinary circumstances, the habitual presence in the urine of albumen in considerable quantity is looked upon as symptomatic of very serious organic disease, and experience shows that we have only too good reason to look forward in such cases with somewhat gloomy anticipations as to the future. There are, however, exceptional instances, such, for example, as arise in the course of scarlatina, in which our prognosis is vastly more favourable. A knowledge of these facts has given rise to numerous speculations as to the nature and exact import of the symptom, when it is observed in the course of pregnancy. The question, in fact, is —are we to consider the albuminuria of pregnancy as indicative of serious disease of the kidneys, or are we, on the other hand, to look upon it as an exceptional symptom of pregnancy, and one to the disappearance of which after delivery we may confidently look forward? In considering, in the light of modern investigation, what answer should be given to this query, we note, in the first place, the fact that the albumen in the blood is somewhat diminished during pregnancy. Along with this we have the researches of Blot and Litzmann, who, by a series of independent observations, have shown that albumen exists in the urine in more than twenty per cent. of pregnant women, while, in the case of primiparæ, the percentage is considerably higher even than this. If we were to admit, therefore, that albumen in the urine was here a pathognomonic sign of equal significance with that which occurs independently of gestation, we must conclude that the mortality of pregnancy and childbed would be thereby in a very great degree augmented. But, as experience shows us the contrary, we are thus, on the very threshold of the inquiry, forced to admit that the albuminuria of pregnancy is comparatively innocuous, and affords us one of the best illustrations we possess of what pathologists now call *Physiological Albuminuria.*

That childbed mortality is, directly or indirectly, increased in some measure by the presence of albumen in the urine, and the associated phenomena, is a fact which no one in these days will gainsay. Among the phenomena here alluded to are puerperal convulsions, a subject to which we shall have occasion specially to refer, seeing that the affection in question is one in which the most serious results not unfrequently ensue. This is, in fact, one of the most interesting and practically important points in connection with the subject, to the demonstration of which Simpson contributed in no small measure, by establishing the intimate association which exists between convulsions and albuminuria. But the unhappy results which frequently attend this complication fortunately do not indicate the ordinary course of an uncomplicated case of albuminuria in pregnancy. The frequency with which this alteration of the urine is to be observed, as has been shown by the observations of Blot and Litzmann already referred to, is sufficient to prove that a large proportion of cases are unattended by any marked symptoms, and, therefore, we may assume, run their course without the nature of the case being so much as suspected. And, moreover, this idea receives the strongest possible confirmation from the fact which experience has fully disclosed, that, in the majority of cases in which albumen is actually detected in the urine by chemical examination during gestation, the general health is little if at all affected, and the normal constitution of the urine is restored within a short period after delivery.

Symptoms.—The Symptoms of this affection are, then, in mild cases, either such as to attract no attention, or are confounded with those which naturally arise from, or are associated with, the pregnant state. When, however, dropsical effusion takes place, which is not, like that which has already been alluded to as the result of mere mechanical pressure, confined to the lower limbs, but affects more or less extensively the whole body, our suspicion should be at once aroused, and a careful examination instituted, when the presence of the abnormal element in the urine will usually be detected. In extreme cases, the legs are enormously swollen, and the vulva and vagina tumefied, while, the characteristic puffiness of the face, with swelling of the upper limbs and of the abdominal walls, indicate still more clearly the nature of the case. The urine is scanty, of high specific gravity, and may become solid on boiling. In the worst cases, and especially in those in which convulsions occur, there is considerable headache, dimness of vision, and amaurosis,—which latter sometimes comes on quite suddenly, immediately before a fit. The blood poisoning, which was assumed to give rise to these epileptiform seizures was long believed to arise from the presence in the blood of urea, which had not been eliminated in consequence of the perverted condition of the renal function. It has been demonstrated experimentally, that placing a ligature on the renal veins, and thereby disturbing the balance of the circulation in the kidneys, causes the appearance of albumen in the urine. From this the inference has been drawn, that the albuminuria of pregnancy was due to the pressure exercised by the gravid uterus. That this is the case in some instances we cannot doubt, but at the same time it is clear that the explanation was too readily accepted as the solution of every case. The fact of its greater frequency in primiparæ and in twin pregnancy, where the pressure is obviously greater, no doubt lends confirmation to the view alluded to; but, on the other hand, instances occasionally occur in which, at an early period of pregnancy, albumen may be detected before any such pressure as would account for it on the above hypothesis could by any possibility occur. "In such cases," says Dr. Tyler Smith, "the disease appears to me to depend upon reflex irritation of the kidneys by the gravid uterus, similar to the irritation of the salivary glands, the mammæ, thyroid, &c., and not upon mere pressure alone." If we reflect for a moment on the condition of the blood and circulatory apparatus in pregnancy, we cannot fail to recognise, both in the composition of the blood itself and in the structural and physiological changes which are known to occur, conditions which may be admitted as at least possible factors in the development of albuminuria. The altered proportion in which we find the various ingredients of the circulatory medium, taken along with a dilated left heart and increased arterial tension, are certainly conditions singularly favourable to the disturbance of the circulation in the ultimate renal vessels and the consequent appearance of albumen in the urine. Just as experiment has proved that ligature of the renal veins causes albuminuria, so with almost equal confidence may we assume that an increased tension of the affluent vessels may produce, and probably does produce, similar results.

The existence of puerperal albuminuria is, as a rule, only recognised during the last months of pregnancy. It by no means follows, however, that this marks the period at which it is first present in the urine. On the contrary, we may be certain that its recognition is often deferred to that period, simply because the symptoms have not been such as to attract particular attention. There is too good reason to believe indeed that, even in cases where the symptoms ought to have excited suspicion, the idea has never been entertained until the occurrence, during labour, of violent convulsions, for the first time directs attention to the fact. The greatest variety exists in the progress and duration of the disease. In some of the cases which have been most carefully noted, the presence of the albumen has not been constant, but has either oscillated in regard to quantity, or has ceased completely for days, to return again—thus repeatedly intermitting during a considerable period. In others, the affection appears to gain ground as the pregnancy advances, and ultimately to culminate in chronic Bright's disease, either in the course of the existing pregnancy or at a still later period. There are, of course, cases in which women who are already the subjects of Bright's disease become pregnant, and in whom all the symptoms suffer aggravation. But what we refer to at present exclusively are those cases in which, at some period in the course of a pregnancy, albuminuria makes its appearance for the first time. The instances in which no serious kidney lesion exists, constitute, happily, the great majority. In such, the albumen usually disappears shortly after delivery;[1] but, in others (as we not unfrequently see after scarlatina), the albumen persists for many months, although the general symptoms are not necessarily severe. Much information may be derived, in doubtful cases, from a microscopic examination of the urine: and in this way, too, our prognosis will, in a great measure, be formed, as the presence of tube casts, and their microscopic characters, will often reveal the nature and stage of the renal degeneration, should it exist. Headache, sickness, and the various forms of digestive disorder which are so frequently associated with pregnancy, are, under the influence of albuminuria, often greatly aggravated; and there can be no doubt that the morbid alteration in the blood gives rise, as has been observed by M. Blot and by Tyler Smith, to dangerous hæmorrhage during or after labour. There is reason to believe, further, that it is in some way connected with the etiology of phlegmasia dolens, perimetritis, and possibly also with what is commonly called puerperal fever.

Treatment.—In reference to the question of treatment, it is obvious that it must be of no small importance to ascertain, as early as possible after its development, the presence of the albumen. More especially is it of importance to be possessed of this information, in order that we may adopt such measures as may remove, or at least mitigate, the symptoms, before the period of labour arrives, at which experience teaches us to dread the occurrence of convulsions and the alarming results which spring from uræmic poisoning. In every case in which the symptoms point in that direction, including even the minor forms of œdema, it is well, as a matter of routine in practice, to test the urine for albumen. Its presence may, doubtless, be discovered in many cases in which no other symptoms exist, and the health of the woman is excellent. If so, the treatment will consist in careful regulation of the diet and of the functions, and in occasional observations of the urine, with the view of obtaining the earliest possible information of any morbid change. If the case is one wholly due to pressure, no serious symptoms whatever may be manifested, and the case may continue until the end of pregnancy, with the result of a normal labour and perfect recovery. Antiphlogistic treatment of any kind, more especially in such cases as are not observed until the disease has made some progress, must be resorted to with the greatest caution. For it must be remembered that the disease is one of debility, and implies impoverishment of the blood—a condition which calls more for a tonic treatment and a generous diet. Baths of various kinds are often useful, being at once grateful to the feelings of the patient and likely to promote the function of the skin. The use of diuretics has also been recommended, but, if used, these agents should be employed cautiously, and in the mildest form. In a case which came under our observation, a lady aged thirty-four, pregnant for the first time, had œdema of the ankles about the beginning of the sixth month, when a trace of albumen was discovered—the urine being very scanty, high-coloured, and loaded with lithates. The treatment adopted was the bitartrate of potash, with Rochelle salts and benzoic acid, which kept the symptoms somewhat in abeyance, and manifestly improved the function of the kidney. The general health did not deteriorate, but the general dropsy increased, the quantity of albumen in the urine fluctuating considerably. All went on well, but, in the second stage of a tedious labour, the patient was seized with a most violent epileptiform attack. She was at once delivered with the forceps, made a good recovery, and in six weeks all trace of albumen had disappeared. In the above case, the benzoic acid was given as recommended by Frerichs, with the view of neutralizing the carbonate of ammonia which he believed to be formed in the blood by the decomposition of the retained urea.

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[1] It has also been observed, as in a case brought under the notice of the writer by Dr. J. D. Maclaren, that the disappearance of the albumen may coincide with the death of the child *in utero*. In the case in question, albuminuria appeared in the course of the sixth month and continued till the end of the eighth, when sudden and profuse diuresis set in, and the dropsy and albumen disappeared in a few days. A week afterwards a dead child was born, which seemed from the state of putrefaction to have died just at the time the diuresis occurred.

The significance of albuminuria during pregnancy has been viewed by some as of such serious import as to warrant the induction of premature labour; but to such an opinion, in so far as ordinary cases are concerned, we are unable to subscribe. So serious, however, is the probable issue of a case in which the quantity of albumen, the degree of œdema, and the general condition of the patient, tend to indicate the highest grade of severity in the symptoms, that we may be quite justified in entertaining gravely the propriety of such a course. But, in such circumstances—and the remark applies equally to all cases in which the question of premature delivery may arise—it is proper not finally to resolve upon such a step without, if possible, obtaining the sanction and approval of some colleague in whose opinion we may have confidence.

Dr. Tyler Smith has pointed out, as an occasional accompaniment of pregnancy, the habitual occurrence of a large quantity of triple phosphate in the urine, which, under the circumstances, is of high specific gravity, and has an alkaline reaction. The same observer has noticed, further, that in some cases in which this phosphatic diathesis has been found to exist, fatty degeneration of the placenta had occurred in successive pregnancies. The treatment of such cases consists in the use of the mineral acids, opiates, rest, and a nutritious regimen.

Leucorrhœa.—A hypersecretion of the mucous membrane of the vagina constitutes a troublesome form of Leucorrhœa, which is of frequent occurrence during pregnancy. A certain degree of this increase in the action of the glandular structures is to be looked upon as an ordinary accompaniment of pregnancy, due to the increased vascularity which is inseparable from gestation, and which manifests itself, as we have already seen, in a change in the colour of the membrane. This, of course, requires no treatment beyond ordinary attention to cleanliness. But the quantity of the discharge is occasionally excessive, and varies greatly in its appearance, being in one case clear, in another milky, and in a third yellow and creamy like ordinary pus. Such a condition is found occasionally to be associated with a growth of papillary projections on the surface of the membrane, which are sometimes as large as small peas, but more generally very minute and spreading over the whole vagina, giving to it a granular appearance. This is what has been called Vaginitis Granulosa, an affection accompanied with irritation and uneasiness, amounting in some instances to pretty severe pain, or, what is even worse, intolerable itching of the parts. The latter symptom may give occasion, even during sleep, to rubbing and scratching of the vulva, which may cause ultimately severe excoriation, and much suffering. When circumstances render it probable that a specific cause exists, we must of course be on our guard against mistaking gonorrhœal or syphilitic discharges for that which we are now considering; and, in cases where the diagnosis may be difficult, the presence of condylomata and other unequivocal specific appearances will serve to remove all doubt. Generally, when the affection is due to pregnancy, even the most profuse discharges rapidly disappear after delivery, and seldom attract any notice after the lochia has ceased to flow. Cases, however, occasionally occur in which such a discharge, originally appearing during pregnancy, lasts during the convalescence after labour, and ends in an obstinate and troublesome vaginal leucorrhœa. The treatment of this affection must necessarily be confined within certain limits, so that sometimes palliation is the most we can hope for. Cauterants, or strong injections, cannot be employed, lest they should induce premature labour, and even the simplest injections must, if used, be employed with the greatest possible caution, as it is well known that repeated injections, even of tepid water, will often suffice to induce uterine contractions. The resources at our command are, on this account, extremely limited, and in most cases must consist in cleanliness, warm baths, and emollient applications. Medicated pessaries of various kinds, such as those which are made with tannin, or with alum and catechu, may also be used with safety and with every prospect of success. If there is much irritation or itching, the ingredients may be varied at will to meet these indications.

Dropsical Affections.—General Dropsy, as symptomatic of, or coincident with puerperal albuminuria, has already been fully noticed. There are other forms, however, of dropsical disease which require attention, among which are Ascites, Dropsy of the Amnion, and the affection known as Hydrorrhœa, each of which calls for special remark. *Ascites* is a form of dropsy, familiar to the physician, and which is of frequent occurrence during pregnancy, and is probably due in most cases to the effects of mechanical pressure. Sometimes it is developed at an early stage of gestation, in which case we should look upon the symptoms with considerable apprehension, as experience has shown that the result is, not unfrequently, fatal to child or mother, or to both. It is rare, however, that it develops itself before the fifth month, and if the patient reaches the termination of the sixth month without ascites, it is unusual for the symptom to manifest itself for the first time after that period. A certain amount of effusion may take place within the peritoneal cavity without attracting any special attention, but as pregnancy advances, the amount of distension is out of all proportion to the stage which has been reached. Examination by the usual process of palpation discloses the fact, in the same manner as under ordinary circumstances, but the site of the chief effusion is varied somewhat in consequence of the presence of the distended uterus. On that account, fluctuation will be perceived most distinctly in the hypochondriac regions, and especially on the left side. The distension, as the case goes on, continues to increase to such an extent as to press injuriously upon the diaphragm and disturb the functions of the thoracic organs, while the amount of mechanical pressure is further shown by the projection of the umbilicus, which often takes the form of a protrusion, several inches in length, and as translucent as the scrotum in hydrocele. The abdominal walls become œdematous and pit on pressure, and if the case is still unchecked, the whole body becomes enormously swollen, while the blue lips, laboured breathing, and rapid feeble pulse show how much the general functions are disturbed. In the course of such a case, the diagnosis of pregnancy is seriously interfered with, and it may be impossible to make out the presence either of a solid body or a distended uterus; and, besides, there is good reason to believe that, the uterus being separated to a greater or less extent from the abdominal walls, the sensation of quickening is deferred to an advanced period of gestation, or in some cases is never felt at all, although the child is alive and vigorous. The worst cases of all are those in which ascites is complicated with dropsy of the amnion, when the prognosis is very unfavourable.

Caution must be exercised in the Treatment of puerperal ascites, in so far as the use of drugs is concerned. It would appear, indeed, that not only is the free use of purgatives and diuretics prejudicial to the pregnancy and apt to bring on labour, but also that those agents have very little effect, in such cases, in checking the advance of the malady. We ought, however, always to try them before resorting to other measures; but, should they fail, and the distension be such as to threaten the life of the woman, we have no choice left save between paracentesis and the induction of premature labour. In deciding between these two modes of procedure, we must be guided by the peculiarities of individual cases. The operation of paracentesis will be preferred in all such as may show a reasonable prospect of thus relieving the woman and allowing the pregnancy to run its course, thereby saving both mother and child. It must be remembered, however, that the operation is very frequently succeeded by uterine contractions, so that the very measure which is adopted with a special view to the safety of the child, may possibly be the cause of its expulsion. In regard to the operation itself, it is clear that seeing we cannot, without incurring the risk of wounding the gravid womb, operate in the ordinary situation, another site must be selected. Scarpa operated in the left hypochonder, and Ollivier punctured on several occasions the protruding umbilicus with an ordinary lancet. Either of these sites might be adopted in cases where the operation had been, after due consideration, resolved upon, employing, however, for the removal of the fluid, the aspirator trocar, which is a great improvement on the old operation, and by means of which the risk is reduced to a minimum. We confess, for our part, that, seeing the frequency with which premature labour has followed spontaneously upon the operation of paracentesis, and the risk of peritonitis which the woman may run as a consequence of it, we look with more favour on the direct induction of premature labour as the proper measure to resort to in extreme cases. The nearer such a case approaches to the full term of gestation, the less need we hesitate in adopting this course; but even when it involves the certain loss of the child, we believe that the most judicious course would be to adopt this, in preference to paracentesis.

Dropsy of the Amnion.—There is, as has already been observed, a very great variety, consistently with quite normal gestation, in the quantity of the liquor amnii. It is, therefore, a matter of no little difficulty to determine the point at which the quantity becomes abnormal, but we shall probably not be wide of the truth if we put down the limit at from two to three pints; so that, if the quantity should exceed this, the case may be held to come under the category of dropsy of the amnion. In extreme cases, from thirty to forty pints of fluid have escaped from the uterus. It was at one time generally believed that this form of dropsy was associated with some special morbid condition. It has been supposed, for example, to be due to inflammation of the amnion, constitutional syphilis, or to some diseased condition of the fœtus; but, although all these theories are possible, none of them have up to this period been demonstrated. It seldom has been observed before the fifth month, and is much more frequent in twin pregnancies.

If any difficulty should be found in distinguishing between ascites and dropsy of the amnion, attention to the following points, which are laid down by Cazeaux as diagnostic, will generally enable us to make the distinction, if the cases are uncomplicated; but it must not be forgotten that the two affections may co-exist. In ascites, the urine is scanty and thick, and the lower limbs and genitals are œdematous. There is also fever and constant thirst. It is difficult, if not impossible, to recognise the outline of the uterus, and in the course of our examination by palpation, distinct fluctuation is to be detected. In dropsy of the amnion, again, there is normal urine and little thirst. The lower limbs are often perfectly free from œdema, or if it be present, it is so to a comparatively small extent. The rounded form of the distended uterus can generally be made out, but the fluctuation is very deep-seated and obscure. There is rarely any umbilical projection, and, if so, it is not transparent. The distension from dropsy of the amnion is sometimes enormous, and may threaten death by apnœa, by interfering with the function of the lungs. The natural relief which has, in such cases, followed upon spontaneous rupture of the membranes and the escape of the fluid, points very clearly to the only method of treatment upon which we can rely ; for, whatever may be the opinions entertained with reference to ascites, there can be no doubt that, in the affection we are now considering, the only operative procedure applicable to cases where life is in danger is the induction of premature labour by rupture of the membranes. If the symptoms are not urgent, and the distension not excessive, careful attention to all the functions is the only mode of procedure which can be adopted, seeing that diuretics and purgatives are of no avail, and, besides, that the pregnancy may possibly come to a satisfactory termination. The result of this affection is very serious as regards the life of the child, but seldom implicates that of the mother, nor indeed, as a general rule, does it seriously affect her health. The natural result is spontaneous premature expulsion.

Hydrorrhœa.—In this singular affection, which has also been called "false waters," a discharge of fluid takes place from the uterus, the amnionic sac remaining entire, and the phenomenon being neither preceded, nor necessarily followed, by uterine contractions. This occurs pretty frequently towards the end of pregnancy, and even although the quantity of fluid discharged may have been considerable, and have led to the idea that premature rupture of the membranes had occurred, labour, when it eventually occurs, is found to be accompanied in the first stage, as usual, by the formation of the "bag of waters." The circumstances under which the discharge occurs vary considerably. In some cases, it has an obvious connection with some powerful effort or accidental violence, while in others it comes on while the patient is at perfect rest, or even during sleep. In one case the discharge may occur as a gush, in another it may escape *guttatim ;* or, it may come on in either of these ways, and then, ceasing completely, may again and again return. The discharge is, in the first instance at least, attended by no pain, but in those cases in which the quantity is large, and the escape sudden, uterine contractions are apt to supervene, and premature delivery thus to ensue.

The cause and source of a serous and usually colourless discharge which comes from the uterus during pregnancy, and is not the liquor amnii, are points of considerable interest, and to account for the phenomenon many theories have arisen. The only one, however, which it is necessary to mention here, as it is that which is almost universally accepted, is that the affection arises from a secretion which has its source in the inner surface of the uterus, and which, in proportion to its quantity, separates the coverings of the ovum from their uterine attachments. A pouch is thus formed between the decidua and the womb, which gradually increases as more fluid becomes effused, until, making its way downwards towards the cervix, it finds a mode of exit, the fluid then escaping into the vagina and making its appearance externally. The treatment consists in enjoining strict rest in the horizontal posture in order to reduce the risk of abortion, and, if the gush has been sudden and the quantity large, it will also be proper to give an opiate in some form, with the same object in view. The only practical mistake which might be made in such a case would arise from an error in diagnosis, for, if we believed the discharge to indicate rupture of the membranes, we might, naturally enough, rather encourage the coming on of labour, assuming that to be inevitable.

Disorders affecting Locomotion.—Attention has already been directed to the fact, now fully recognised, although long disputed, that a relaxation of the various pelvic articulations is an essential and physiological accompaniment of the pregnant state. This consists in a thickening of the cartilaginous, and a softening and relaxation of the ligamentous structures surrounding the articulations in question. Along with this there is a greater afflux of blood to the parts, and the more perfect structure of the joints at these times—as shown, for example, in the increased secretion of synovial fluid—indicates that nature makes, as it were, an attempt to establish here what exists in so many of the lower animals. The amount of motion which is thus permitted is, with the exception of the sacro-coccygeal joint, very trifling in normal cases, for, were it otherwise, the power of locomotion would be seriously interfered with. A certain number of rare instances have, however, been recorded, which suffice to show that the articulations may be relaxed in an unusual degree, and thus a morbid condition ensue. Cases have, indeed, been examined by Morgagni, Hunter, and others, in which the separation between the pubic bones at the symphysis exceeded an inch, and in such cases great increase of the synovial secretion has been observed. The woman complains first of pain and uneasiness, which is aggravated on walking, or even by a trifling movement of the trunk. From being intolerable, locomotion becomes impossible; and, on careful examination, movement of the joint, attended with synovial crepitation, may sometimes be induced. Absolute rest should, as a matter of course, in all such cases be strictly enjoined, for every movement either of the trunk or lower limbs will increase the morbid mobility, and by accustoming the joints to move, will render a cure, which cannot be looked for till after labour, vastly more tedious. After labour—the severity of which this affection will rather tend to mitigate—a similar course of treatment must be persevered in, to encourage the parts to resume their former condition. This will also be promoted by firm bandaging round the pelvis, so as to bring the ossa innominata more firmly together, and by the use, it may be, of some more rigid mechanical support, such as the steel girdle devised by Martin of Berlin. We have known, under such circumstances, locomotion rendered impossible for many months after delivery. Inflammation of the pelvic articulations is another occurrence which may call for attention, but cases of this affection are extremely rare.

Locomotion, which is generally somewhat impeded in the last months of pregnancy, may be rendered extremely painful, or at least very uncomfortable, by many of the affections which we have been considering. Cases, for example, of relaxation of the abdominal walls in pluriparæ, and the anteversion of the womb which often accompanies it, are often attended with this inconvenience, which, under such circumstances, may be greatly relieved by the use of an abdominal bandage, so adjusted as to support the displaced womb.

Disorders affecting the Nervous System.—The extent to which these may be multiplied by classification is almost illimitable. We shall here, however, confine our attention to a few only, leaving the more important of them to be discussed in a future chapter, and passing over such as may be treated on general principles. The functions of each of the organs of special sense may be disturbed during pregnancy, and we may therefore meet with cases of deafness, aversion to certain odours or perfumes which may previously have been deemed agreeable, dimness of vision, and even amaurosis, and, as regards the sense of taste, peculiarities are in this respect among the most familiar accompaniments of the pregnant state. Vertigo, flushings, syncope, and even itching of the skin, in the absence of any cutaneous irritation, must also be referred to the same class. Nor do the moral and intellectual faculties escape, in all cases, without suffering material disturbance. The subject of mental alienation in the puerperal state will hereafter be more fully discussed, but there are minor degrees of aberration, both moral and intellectual, which do not amount to, or even approach insanity, but which are by no means of rare occurrence during gestation. Affection may, in this way, be replaced by unaccountable antipathy, a trusting disposition by jealousy, or a temper which can scarcely be ruffled by wanton irritability.

Amusing cases are even narrated, in which quite the contrary was the result, and in which whole households learned to hail with pleasure the pregnancy of the lady of the house, which was divulged to them by unwonted gentleness of manner and genial cheerfulness. "It is not uncommon," as Burns says, "to find women very desponding during pregnancy, and much alarmed concerning the issue of their confinement." This affection, closely resembling a similar state occasionally attendant upon disordered menstruation, amounts, when extreme, to melancholia, and seems, in both cases, to have its origin in an irritation which, starting from the uterus, operates reflexly through the nerves. Cheerful society, and careful attention to the diet and bowels, constitute, along with other similar measures, the only treatment proper to such a case.

Pain, unconnected either with uterine contraction, or with inflammation, and referrible to any one point in the abdomen, is an occurrence which occasionally, from its severity, calls for interference. In a certain number of such cases, there is, no doubt, as Scanzoni points out, an abnormal tenderness of the womb, which many have attributed to rheumatism of that organ, during which either the whole womb, or a limited portion of it, may be the seat of very acute pain. When this is the seat of the pain, it is usually referred to the hypogastric region; but there are many other instances in which pain of an equally acute character is experienced in other regions. Pain in the groins, which has been supposed to be caused by dragging on the round ligaments, will be best relieved by a broad abdominal bandage and the horizontal posture. Pain in the lumbar region has, in like manner, although on what ground it is not clearly shown, been attributed to stretching of the broad ligaments. Pain and cramps in the thighs are most distressing accompaniments of pregnancy, and are due, in part to pressure on the sacral nerves, and in part to a reflex action, starting most likely from the uterus, but probably, in some instances, from the bowels. The abdominal walls also seem, in some cases, to be the seat of acute and almost constant pain. This occurs during the last months of pregnancy only, and is generally confined to a limited space on the abdominal surface,—so that it is often difficult to convince the patient that it does not mark the seat of some severe local inflammation. All such painful affections as we have alluded to must be treated, during pregnancy, by the agency of measures which are merely palliative, and, in point of fact, palliation is the most that experience of such cases teaches us to anticipate. Warm baths in all cases, laxatives in the case of cramps, rest and local applications for the relief of the pain, are the only agents which, in most instances, can be employed; for opiates and other anodynes are very generally contra-indicated, in so far as their internal administration is concerned. Among external applications may here be mentioned the soap and opium liniment, chloroform with tincture of aconite, and belladonna plasters. In the worst cases, morphia may be resorted to, in the form of suppository or subcutaneous injection. The increased sensibility of the uterus is, in some of these cases, associated with particularly active fœtal movements; and, very often, pain, which has been relieved or deadened, is again awakened by a sudden movement, a sneeze, or a cough.

Displacements of the Gravid Uterus.—Certain displacements or dislocations of the womb, which are of frequent occurrence in the unimpregnated state, exist also, although more rarely, during pregnancy. The reason of the comparative infrequency is to be found in the fact that, while in all probability impregnation takes place in some instances of uterine displacement, the general effect of the subsequent development of the uterus in the course of pregnancy is to reduce the dislocation, and thus to avert the disastrous consequences of its persistence. Frequently, however, marked flexion or version of the unimpregnated organ is a barrier to pregnancy.

Prolapsus.—In the affection known as Prolapsus or Procidentia, conception may occur, and that even in cases where the uterus projects externally. But, while prolapsus frequently precedes impregnation, the details of some cases would seem to show that sometimes the prolapse succeeds the conception, the uterus descending instead of ascending as the development progresses, while the further growth of the organ takes place without its ever rising into the abdominal cavity. Examples of this have been recorded by Portal, and by others whose statements we cannot permit ourselves to call in question. In some of these instances, development has gone on entirely within the true pelvis. Up to a certain point, the uterus may no doubt occupy this situation without causing any symptoms of discomfort, and this in fact is what takes place, as we have seen, in the first three months of normal pregnancy. But, should any mechanical impediment prevent its further expansion in the direction of the abdomen, or should any other cause induce its prolonged sojourn in the pelvis, the pressure which is exercised upon the bladder and rectum interferes seriously with their functions, and the case goes on, with great suffering to the patient, until nature relieves herself by expelling prematurely the contents of the womb. Those instances in which it is reported that pregnancy went on uninterruptedly, must, we presume, have been cases in which the cavity of the pelvis presented very unusual dimensions. In some of them, the uterus projected partially, but the most extraordinary of all, are those in which prolapsus has been complete, the gravid uterus lying in the form of a huge tumour between the thighs of the mother; and, incredible though it may seem, it has been asserted that under such circumstances, pregnancy has reached its normal termination without any special danger either to mother or child. The usual result is that abortion occurs before the end of the fifth month, as in cases narrated by Levret, Capuron, and others. The treatment will consist mainly in careful attention to the functions of the bladder and rectum, and in watching the progress of the case. When the prolapse has preceded pregnancy, and circumstances point to the possibility of an occurrence such as we are now considering, we should watch the case carefully as the period approaches at which the uterus should rise above the brim, and, if necessary, afford it some aid by careful manipulation, as was done by Scanzoni in two cases. Should the organ appear externally, similar efforts should be made, failing which, it must be supported by an external bandage, or by a pessary applied internally. But, so soon as dangerous symptoms manifest themselves, or the bowels or bladder are so obstructed as to render defæcation or micturition impossible, our course of procedure is clearly to act promptly, in such manner as may seem most judicious, with a view to the immediate expulsion of the contents of the uterus, for to allow such a pregnancy to continue would be to compromise the life of the mother without saving that of the child.

Anteversion and Anteflexion.—These forms of displacement are of rare occurrence during the early months of pregnancy. This is what an observation of the anatomical relation which the organ bears to the pelvic walls would have led us to anticipate; and, as Kiwisch has well observed, any such tendency which might exist is obviated further by pressure directed upwards against the fundus by distension of the bladder, and downwards against the vaginal portion by repletion of the rectum. Cases have, however, been occasionally observed, giving rise to symptoms indicating obstruction to the action of the bowels and bladder. The digital examination which such symptoms suggest reveals at once the nature of the case, the cervix being high in the hollow of the sacrum, while the fundus forms a rounded tumour in the roof of the vagina in the direction of the bladder. In such a case, the patient should be directed to lie on her back as much as possible; and, when the period arrives at which the uterus no longer finds accommodation within the pelvis, the fundus will rise upwards, and will thus spontaneously relieve any uneasiness to which the displacement may have given rise. This is the natural issue of such a case; but it is quite possible that, in some instances, the dislocation may be reduced by careful pressure upwards of the fundus by the finger which, however, should only be attempted if the severity of the symptoms warrants interference. In the latter months of pregnancy, anteversion is of more frequent occurrence, and is then associated with the phenomenon of pendulous abdomen. It is observed almost exclusively in multiparæ, in whom the abdominal walls have been subjected to repeated distension, and in those, it is said, in whom the inclination of the pelvis is greater than usual. In direct proportion to the degree of displacement is the amount of pressure to which the bladder is subjected, and, consequently, the degree of discomfort to which it gives rise by impeding the flow of urine. In some instances, the abdominal wall not only projects forwards, but hangs downwards, and to those cases the term anteflexion is more applicable than anteversion, as the axis of the uterus is then bent in a greater or less degree. In extreme cases, the walls of the abdomen have been observed to hang down as far as the knees, but it seems likely that in most of these there is an actual hernia of the womb, owing to a separation of the recti muscles, between which it protrudes. This form of displacement may, as we shall have occasion hereafter to observe, cause difficulty in the process of parturition, by misdirecting the expulsive force; but, in every case, the treatment is the same, and consists in an endeavour to raise the fundus by a bandage, supplying in this way the support which the abdominal wall should afford, and, in addition, attending to the function of the bladder, remembering always that the greater the displacement of the womb, the greater is the corresponding elongation of the bladder. That organ, indeed, in some cases, loses all trace of a spheroidal form, and assumes the shape of an elongated pouch, which is bent over the symphysis, and which, therefore, can only be conveniently emptied by the use of a long elastic catheter.

Retroversion and Retroflexion of the gravid uterus are much more dangerous both to mother and child than displacements in the contrary direction. The distinction between the two varieties depends simply as the names imply, upon whether the long axis of the uterus is straight or bent, and in each the fundus of the uterus occupies more or less completely the recto-vaginal pouch of the peritoneum. We believe, however, that the distinction which is usually drawn between retroversion and retroflexion is, in the unimpregnated state, more apparent than real. The majority of cases will be found in fact, on careful examination, to be neither exactly the one nor the other, but a condition intermediate between the two, in which the axis of the uterus is neither straight nor abruptly bent at the os internum like the neck of a retort, but forms the arc of a circle, the imaginary radius of which varies very greatly. But, in the corresponding displacements of pregnancy, the distinction is more marked, and, as the clinical history of the two classes of cases is essentially different, it is necessary that a clear distinction be drawn between them.

The development of an impregnated ovum may take place in a womb, the fundus of which has been displaced backwards prior to conception. In this case, the displacement is almost always a flexion which becomes more distinct as pregnancy advances. It has been supposed, and we believe with good reason, that there is an unusual mobility of the uterus in the direction which corresponds to the original displacement in the case we are now considering. This is due to a morbid relaxation and lengthening of the round ligaments and vesico-uterine folds, which thus admit in the first instance of a movement of the fundus backwards, encouraged by repletion of the bladder, and still more by over distension, arising either from carelessness or some other cause.[1] The effect of the combined action of these two causes is to induce a certain degree of movement backwards, which other circumstances may tend to aggravate or complete. While the uterus is in its normal position, it is impossible that distension of the rectum can cause retroversion, but so soon as the causes above detailed, or others to be mentioned presently. have acted so far as to press the fundus below the promontory of the sacrum, then this new force comes into play, the fæcal masses, as they descend, gradually forcing the fundus further and further down into the pouch of Douglas, until a marked case of retroflexion is the result. The other causes alluded to as auxiliary forces, are the downward pressure exercised by the abdominal viscera, and the existence of fibroid growths in the posterior uterine wall. At any stage, impregnation is possible, and it is easy to understand how, in such a case, a comparatively slight displacement may be converted into one in which the fundus fills the hollow of the sacrum, and may actually reach as far down as the coccyx. Before long, however, the limited space, within which, in this position of the uterus, the development of that organ goes on, becomes filled, and the pressure upon the bladder and rectum calls immediate attention to the case. An examination discloses the altered anatomical relations of the parts. The os and cervix will generally be found about the level of the sub-pubic angle, or somewhat above it; while, behind this, and about the same level, a firm rounded tumour is felt, apparently occupying the recto-vaginal pouch, and pressing forwards the posterior wall of the vagina. (Fig. 109.) On examination by the rectum—into which two fingers are to be passed as high as possible—the same tumour is felt through the anterior wall, but in this method of observation, considerable difficulty will often be experienced in passing the finger, owing to the great pressure to which the bowel is subjected. Backward displacement of the gravid womb has generally been observed in the third or fourth month of pregnancy, but cases are recorded by Smellie, Bartlett, and others, in which it was observed as late as the fifth or even the seventh month. It is more than likely, however, that, in those instances, what Scanzoni describes as partial retroflexion was mistaken for complete dislocation of the organ. The partial retroflexion here referred to

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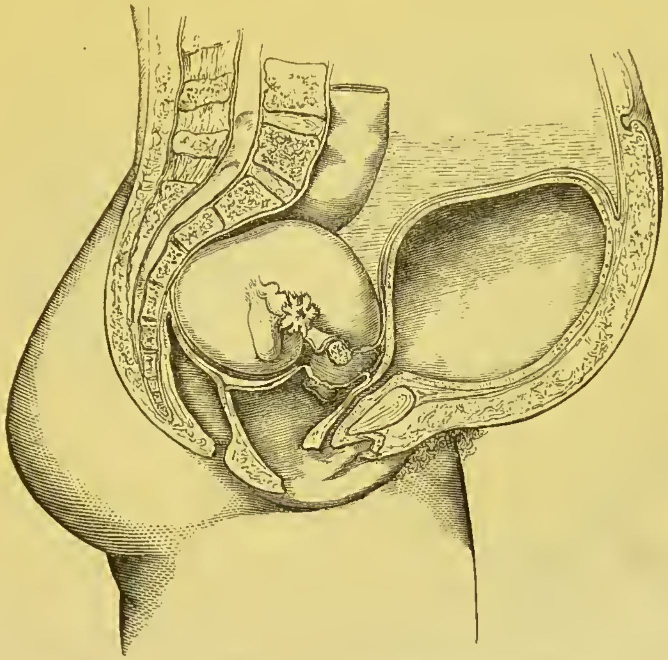
[1] With a view to the elucidation of the subject, Scanzoni made a series of most interesting observations both in the living and the dead. He found, in the first place, that distension of the bladder always caused a certain amount of displacement backwards of the fundus. "We found," he says, "when we artificially filled the bladder in dead bodies, that the duplicatures of the peritoneum passing from the uterus to the bladder, stretched themselves in direct proportion to the distension of the bladder, so that when the bladder was filled and distended as far as possible, this stretching reached to such an extent that it was impossible, without considerable effort, to force the fundus of the uterus backwards for more than a few lines, as its attachment to the posterior wall of the bladder was much more firm than when that viscus was empty. A very different result ensued when we, in the first instance, cut the round ligaments and the peritoneal duplicatures above alluded to, and then filled the bladder. In this case, by a moderate distension, the fundus uteri was strongly displaced backwards, and the vaginal portion forwards, so that it depended upon our will, by the injection of a greater or less quantity of fluid into the bladder, to induce a higher or lower grade of retroversion."—*Lehrbuch der Geburtshilfe.*

Fig. 109.



Retroflexion of the Womb about the 16th week. (Schultze.)

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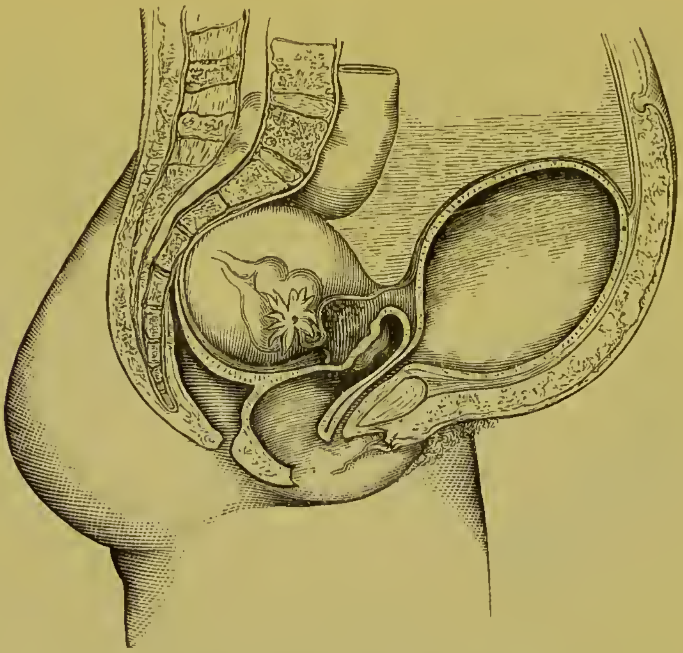
would be more accurately described as a peculiarity in the shape of the uterus, in consequence of which its posterior wall forms a tumour which, owing to some peculiarity in the position of the child, projects into the recto-vaginal pouch, and thus resembles an ordinary case. Assuming that this does actually take place, the occurrence is possible at a much more advanced period of pregnancy, when the development upwards of the remainder of the uterus would probably enable us, without much difficulty, to recognise the nature of the case.

Acute Retroversion.—Of much more frequent occurrence than that which we have just described—and which we may call the chronic form—is acute retroversion in pregnancy. (Fig. 110.) This affection occurs suddenly, but it is most likely that there is a pre-existing minor degree of displacement, which gives rise to a further and sudden change in the position of the womb sufficient to cause complete retroversion. Immediately upon the occurrence of this dislocation, or within a very short period, the woman complains of severe dragging pain, which is accompanied by a new sensation, as of a foreign body in the pelvis. This gives rise to painful and fruitless expulsive efforts, with increase of the pain around the entire pelvis, and great difficulty in emptying the bladder and the rectum. In this case, the axis of the womb being straight, the os uteri is tilted up behind the symphysis, being often as high as its upper margin, so that it is a matter of difficulty to reach the

Fig. 110.



Retroversion about the 12th week. (Schultze.)

os. These symptoms are usually attended with faintness, nausea, and vomiting, and other general symptoms of even greater severity; and, unless the reposition of the organ be speedily effected, this state of matters gives rise to complete retention of urine and obstruction of the bowels, which may, in their progress, result in rupture of the bladder, stercoraceous vomiting, ileus, and such symptoms as precede a fatal result. In many cases—perhaps in most of those in which the incarceration of the organ is prolonged—there is congestion and thickening of the uterine walls, and this may sometimes amount to actual inflammation of the organ, which becomes exquisitely tender, and thus aggravates greatly the sufferings of the patient.

The natural termination of a case such as this involves great risk to the mother, and almost certain death to the child. For, although in its further development the womb may possibly take an upward direction and the symptoms be thus spontaneously relieved (and such cases are on record), the usual result unfortunately is, that the increase of the uterus gives rise to the more serious symptoms above detailed, which can only be relieved by arrest of development, or by expulsion of the fœtus. Nothing can, therefore, be more obvious than the necessity which exists for prompt action in the way of treatment. Should the congestion of the womb be marked, benefit will be derived in the first instance from the use of warm baths and injections, and local or even general blood letting; and when these measures have had time to act, attempts are then to be made to effect the reposition of the organ, taking care, of course, in the first place, that the bladder and rectum have been thoroughly emptied.

Treatment of Retroversion.—The woman having been placed in the ordinary midwifery position with the nates projecting over the edge of the bed, or on her elbows and knees, the index and middle fingers, previously well oiled, are introduced into the rectum, so as to bear against the tumour,[1] and an effort is then to be made, by means of steady pressure in the axis of the brim, to push the fundus beyond the promontory of the sacrum. It will be observed, should it be found possible to displace the fundus to any extent, that the movement takes place not directly towards the promontory, but rather towards the sacro-iliac synchondrosis of either side; and, as we cannot tell beforehand to which side it will incline, although the probabilities are in favour of the right, we must, in the first instance, push directly upwards. But, should the fundus obviously tend to move in the direction of one sacro-iliac joint in preference to the other, the direction of the pressure must then be altered, in order to accommodate it to the tendency thus exhibited. If the compression of the rectum is such as to prevent the introduction of the fingers to a proper height, Kiwisch suggests that we should substitute the handle of a silver spoon or of a sound for the finger. Should a first attempt at reposition fail, we may pause, and endeavour, by means of repeated injections, cold or warm, still further to reduce, if possible, the intumescence of the womb. The patient may then be brought fully under the influence of chloroform, and the attempt renewed in a different posture, when, in many instances, the dislocation will be happily reduced, the womb being occasionally restored to its normal position, as in the case of its inversion, with a snap or jerk. Should difficulty occur in the introduction of the finger into the rectum, it will be proper to make an attempt by the vagina, although in this case, as a little reflection will show, the attempt will be made at a greater mechanical disadvantage than when the rectum is selected. Failing all these methods, we may attempt to dislodge the fundus by the introduction, as high as is possible, into the rectum of an elongated air bag, such as those invented by Barnes for dilating the os and cervix in inducing premature labour. These bags have a long tube fitted at the end with a stopcock, and through this the injection, either of air or of water, causes a graduated pressure which acts continuously, and at the same time effectively, upon the displaced fundus, so as gradually to effect its reposition.

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[1] Scanzoni recommends that the thumb of the same hand should be introduced into the vagina, mainly with the object of elevating the perineum, and thus allowing the examining fingers to pass higher.

All attempts at reduction having failed, the best mode of procedure is to adopt only such measures as are necessary for the relief of the bladder and the rectum, so long as the symptoms are not so severe as to call for immediate action. But, should the emptying of the bladder become impossible, or should any other symptom develop itself which may be held to imply that the life of the mother is in danger, there then remains for us no resource but to imitate nature, and to induce, without delay, the premature expulsion of the fœtus. Of the many methods by means of which, as we shall have occasion again to observe, it is possible to induce premature labour, that which is most applicable to the present case is the rupture of the membranes. For the immediate effect which is thus produced by the sudden evacuation of the liquor amnii, is to reduce the diameters of the uterus, and thus to afford partial relief during the period which intervenes between the operation and the commencement of uterine action. It is, however, by no means an easy matter in every case to effect this rupture, more especially when the os is tilted up behind the symphysis, and is only reached with difficulty, and it may be found necessary on that account to introduce a catheter, with an opening at the extremity, through which a wire may be passed, and having reached the membranes, to thrust the wire through, and thus effect our purpose. But it may happen, unfortunately, that the os is displaced upwards to such an extent that it is impossible to reach it, or at least to pass anything through it, and in such circumstances we have no alternative, if the life of the mother is in obvious danger, but to puncture that portion of the uterine wall which lies lowest, and thus give vent to the amnionic fluid, and afford relief to the patient. It is of course safer, under such circumstances, to puncture from the vagina than from the rectum, but the latter operation has been successfully performed, effusion into the peritoneal cavity having been prevented, by leaving the canula *in situ* until the risk of further effusion had passed. The uterus being thus relieved of its fluid contents, may now be replaced without much difficulty (unless adhesions should chance to have occurred), and then awakened expulsive effort will speedily relieve the organ of its solid contents. Where reposition of the uterus has been successfully effected, labour may go on without any further accident or hindrance, but in some few instances it would seem that a tendency to relapse remains. This must therefore be guarded against, by insisting upon strict rest on the side, and by the frequent use of the catheter and enemata, to prevent such mechanical pressure from the bladder and rectum as might encourage a recurrence of the displacement.

Oblique displacements of the uterus have been insisted upon by some writers as exercising an important influence on the progress of pregnancy. We know already that the long axis of the gravid uterus does not correspond with the middle line of the body. It is quite possible, therefore, that when this normal obliquity is exaggerated, the os may, for a time, be prevented from dilating by the altered axis of the expulsive force. Such displacements, however, seem to have had their origin in a great measure in the imagination of those who have sought to reduce the art of midwifery to a series of geometrical propositions, and are certainly not of sufficient practical importance to require more particular attention.

In addition to the diseases of pregnancy which we have described, there are others, chiefly constitutional, which exist both during and after labour, the consideration of which we shall, therefore, in the meantime, defer.

CHAPTER XV.

LABOUR AND ITS PHENOMENA.

CAUSES OF LABOUR—*Maturity: Antagonism between certain Groups of Uterine Fibres: Brown-Séquard's theory: Labour coincident with the Tenth Menstrual Period.—Forces by which Delivery is Effected: Nervi-motor Functions of the Uterus: Effect of Emotional Causes: Reflex function of the Spinal Cord: Peristaltic Action: Auxiliary force in the Muscles of Expiration.*

STAGES OF LABOUR—*Preparatory Stage.—First Stage: Labour Pains; their effects on the Maternal Pulse and on the Uterine Souffle: False Pains: Mechanism of the Dilatation of the Os; the Bag of Waters; Effect of Longitudinal Fibres: Termination of First Stage in Rupture of Membranes: Rigor: Show.—Second Stage: Change in character of the Pains; the "Caput Succedaneum:" Action of Voluntary Muscles: Dilatation of the Perineum: Birth of the Head and Trunk.—Third Stage: "Dolores Cruenti:" Separation and Expulsion of the Placenta; Mechanism of this.*

THE first point which, in considering the subject of Labour, attracts our notice, is one which has given rise to many interesting physiological speculations. We refer to the causes which lead to the occurrence of delivery, in almost all cases in which the course of pregnancy is undisturbed, at a certain fixed period, calculated from the assumed date of conception. In ancient times, the idea prevailed that the fœtus was itself the principal agent in effecting its birth, breaking the membranes, and opening up the womb in its efforts to reach the external world after the same fashion as the chick when escaping from the thraldom of the egg. The advance of physiological science generally, and more especially the discovery and demonstration of the contractility and muscular structure of the uterus, while they showed clearly enough how erroneous this opinion of the ancients was, did not disclose, and as yet have not clearly revealed, what is the determining cause of uterine contractions at the period alluded to. There exists, say some, a natural antagonism between the muscular fibres of the body of the uterus and those of the cervix, and, so long as the obliteration of the cervix is not effected by the progress of development towards the end of gestation, the tonic contraction of the fibres of the body is not sufficient to overcome the resistance offered by the cervix. But, so soon as the process of dilatation has entirely invaded the cervix, the fibres of the body for the first time prevail, and the contractions, assuming a rhythmical method of action, gradually increase in intensity until they result in real labour pains. Others, and among them Dubois, recognising the exact analogy which subsists, in regard to the distribution of muscular fibres and nerves, between the uterus and the other hollow viscera, and assuming that in the uterus, as in the rectum and bladder, contraction may be awakened by irritation of the cervix (to which alone, as we have already seen, the nerves of animal life are supposed to have access), believe that in these facts the secret is revealed. They hold that complete obliteration of the cervix involves the highest grade of physiological development to which its fibres can attain, and that the sphincter fibres are then for the first time fully susceptible of external influences, communicated to them through cerebro-spinal nerves. And they conclude that, in this manner, the first excitation reaches the cervix, and thus contraction of the whole organ ensues.

A most ingenious theory has been founded by M. Brown-Séquard on the result of certain experiments which he performed by tying the trachea of pregnant animals, in whom he had previously destroyed the lower portion of the spinal cord. The immediate result of the apnœa thus artificially induced, was the occurrence of uterine contractions, which disappeared on relaxing the ligature, and returned again on repeating the experiment. This is due, says the experimenter, to the contact of venous blood with the muscular fibres, the irritability of which is highly exalted during pregnancy. He explains the earliest uterine contractions on the same principle. The large size of the uterine sinuses ensures the presence in the substance of the uterus of a large quantity of venous blood, and so soon as the muscular fibre reaches, at the termination of pregnancy, its highest point both of irritability and of development, it becomes for the first time excited to contraction. The immediate result of this is to empty, in a great measure, the sinuses of blood; but, so soon as the rhythmical relaxation occurs, the venous blood again gains access to the irritable fibres, and anew excites them to contraction.

Whatever view we may be inclined to assume in reference to the cause of labour, there can be no doubt that it is coincident with the maturity of the fœtus. Gradual relaxation of the anatomical connections between the uterus and the ovum, is another undoubted phenomenon which immediately precedes birth, and it was in this that Simpson believed the determining cause to reside. And, finally, Dr. Tyler Smith has suggested—and argues with great ability in favour of the theory—that the cause of labour is to be found in the ovary. "It is allowed by all observers," says Dr. Smith, "that labour has a tendency to occur, and does occur, in a great proportion of cases, in the fortieth week from the last menstruation; and it is equally allowed that impregnation is generally effected just after the catamenial period. It is also made out by the record of a considerable number of cases in which a single coitus occurred, that gestation lasts, on an average, about 275 days from the actual date of impregnation. These dates make the average duration of pregnancy approach 280 days from the last catamenial period, and the occurrence of parturition is, on the average, very nearly a multiple of a single catamenial period."[1] We confess that the arguments which the author advances in support of his theory, seem to us in a great measure to warrant the conclusion at which he has arrived; but, while we admit that it is probable that a presiding influence springs from the ovary at the period of the natural menstrual molimen, we by no means wish to commit ourselves to the opinion that it is the sole cause.

Forces of Labour.—Whatever we may assume the cause of labour to be, the immediate effect of its operation is to rouse the latent energy of certain Forces, by means of whose active co-operation the delivery of the woman is effected. The prime force, to which the others are merely subsidiary, is, as is well known, the contraction of the muscular fibres of which the uterus is mainly composed. That these contractions are of very considerable power, is proved, not merely by the resultant of the force, as shown in the expulsion of the fœtus, but also palpably to the senses by the contraction which may be seen and felt through the abdominal walls, and by the effect which is produced on the hand when introduced into the uterine cavity. Dr. Matthews Duncan has computed this force as equivalent to a pressure of 3 lbs. on the square inch.

In considering the nervi-motor functions of the uterus, we observe, in the first place, that volition exercises no direct influence whatever on the contraction of the uterine muscular fibre; although, as we shall see, it presides over what will be afterwards described as the auxiliary forces. In cases of cerebral paralysis, and when the action of the will has been completely suspended by chloroform, we find that uterine contractions are quite undisturbed. Nay, stranger still, we know that, in some instances, contractions may occur after death, giving rise to post-mortem delivery. There are cases, at least, in which this phenomenon is due to actual contraction of the fibres; but we must be careful to draw a distinction between these and cases of expulsion which have occurred some days after death, and which have been found to be due either to *rigor mortis,* or to pressure from the development of gas in the process of putrefaction,—a condition which gives rise to other strange phenomena familiar to the student of medical jurisprudence.

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[1] The following observation by Harvey has an interesting bearing on this point:—"Unquestionably," he says, "the ordinary term of utero-gestation is that which we believe was kept in the womb of His mother by our Saviour Christ, of men the most perfect; counting, viz., from the festival of the Annunciation, in the month of March, to the day of the blessed Nativity, which we celebrate in December. Prudent matrons, calculating after this rule, as long as they note the day of the month in which the catamenia usually appear, are rarely out of their reckoning; but after ten lunar months have elapsed, fall in labour, and reap the fruit of their womb the very day on which the catamenia would have appeared, had impregnation not taken place."—"On Parturition." Sydenham Society Translation, 1846-47.

Certain Emotional Causes produce an effect on the uterine contractions which it is not easy to account for. Few occurrences are more familiar to the accoucheur than the effect which his arrival frequently produces upon the progress of labour, by causing a complete temporary cessation of all uterine effort. On the other hand, sudden mental emotion of any kind may, by augmenting the force and frequency of the expulsive action, sometimes influence the progress of labour in a marked degree; and this has been observed to occur upon the threat of using instruments, or upon the display of the forceps. Causes, then, which, being psychical, have their origin in the cerebrum, may act either by increasing or by arresting uterine effort.

The Spinal Cord exercises upon the uterus a very obvious and important influence. There is, in the first place, a direct or centric action, in which the motor nerves are excited by a communication starting from the nervous centre; and it is in this way that ergot and other oxytocics act, being conveyed to the cord by the circulation, and there producing an effect which is transmitted to the uterus, where it takes the form of muscular action. In this manner, too, some diseased conditions of the blood produce an effect, as is well known, by acting on the cord, and giving rise to different varieties of puerperal eclampsia; and in this way even plethora, or anæmia, may exercise an influence on the dynamic force of the womb. But of much greater importance, and of higher physiological interest, is the diastaltic, or Reflex Function of the Cord, which chiefly presides over the expulsive action of the uterus. One of the most familiar instances of this is the uterine contraction which ensues upon the irritation of the nipple by the contact of the child. The impression is, in this case, conducted to the spinal centre, and being thence reflected to the uterus, forthwith acts upon its contractile fibres; indeed, so constant is this occurrence, that it is admitted in practice as a valid reason for putting the child to the breast at an early period after delivery. A similar effect may be produced, although with less certainty, by an irritation of a similar kind starting from the stomach, rectum, or any other part of the alimentary canal, from the ovary, or from any structure in the immediate vicinity of the uterus; and, finally, from the direct irritation of the organ itself, which may be effected in various ways, the most reliable of which is irritation of the os and cervix, or of the internal surface in the case of hæmorrhage. The very extensive nervous sympathy which thus exists between the uterus and so many distant parts, shows pretty clearly that its nervous functions are, during pregnancy and the puerperal state, greatly increased. What is known, up to the present time, in reference to the uterine nerves, is by no means very satisfactory; but the result of most modern investigations in regard to these nerves, which are only to be traced with the greatest difficulty, seems to confirm the view originally adopted by Dr. R. Lee, that they undergo, during pregnancy, considerable enlargement—an enlargement, however, which appears to have its seat mainly in the neurilemma. This subject is one which has given rise to a deal of acrimonious discussion, and is still beset with difficulties which have only been partially overcome. It was stated in a former chapter that twigs of the sacral nerves, passing to the os and cervix, constitute the channel of communication between the cord and the uterus, but that the rest of the nerves are derived from the ganglionic system. When, therefore, nervous force is reflected upon the uterus from the cord, it passes by the nerves in question, and reaches, in the first instance, the cervix and os. In this situation plexuses are found, to the formation of which the spinal and ganglionic systems contribute, and through these the force is transmitted to terminal fibres in the body of the organ, where it excites immediate and effective contraction.

It is well known that the hollow viscera, which are supplied in whole or in part by the ganglionic nerves, contract, when irritated, after a fashion peculiar to such structures. The contraction, instead of being limited to the immediate vicinity of the point of irritation, is propagated in a definite direction in rhythmical waves, successive groups of fibres being thus excited so as to constitute the phenomenon commonly known as peristaltic action. The uterus forms no exception to this general law, and its peristaltic or ganglionic motor action was observed and described by Harvey and William Hunter, and by every physiologist of note since their day. The manner in which peristaltic uterine action occurs is, as Wigand has taught, in so far as the contractions of labour are concerned, as follows:—The earliest contractions always take place at the neck, which grows tense. From this point, the vermicular action extends gradually upwards in the direction of the fundus, from whence it again returns towards the os, obvious mechanical advantages, of which we shall speak presently, being attendant upon this method of action. Uterine expulsive action is thus a composite force, which is partly diastaltic and partly peristaltic. Physiologists have sought, by many ingenious experiments on the lower animals, to ascertain what is the precise share which is to be attributed to the reflex function of the spinal cord in producing the phenomena of labour. These experiments have usually taken the form of section of the spinal cord at a certain level, or destruction of the lower part of the cord; and it has been found that the latter procedure has produced the most decided effect in arresting uterine action. In most of these cases, however, it would seem that the peristaltic action remained, and that there was still sufficient expulsive force left to effect delivery. In some cases, it would almost seem as if destruction of the lower part of the cord put an end to all uterine action, but there are obvious sources of fallacy connected with such a method of investigation which render it necessary to exercise great caution before coming to a positive conclusion. It is, indeed, a very difficult question, and one which still remains for solution, whether or not, all connection with the nervous system of animal life being cut off, peristaltic contraction remains possible; for it must not be forgotten that, however thoroughly we may destroy the lower half of the spinal cord, there still remains, in the connections which subsist between the sympathetic system and the upper part of the cord, a possible, though circuitous route, through which the important influence of the cord may still, although more feebly, be exercised.

Auxiliary Forces.—In making the assertion that the will has no influence directly upon the contraction of the womb, we must not be understood as implying that the will exercises no influence on the progress of labour. For we shall see immediately that there is a stage of labour at which the voluntary muscles are brought into play as an auxiliary force, and that the woman instinctively avails herself of their aid. The diaphragm and the abdominal muscles are the chief agents of this new power, and everything therefore which gives a fixed point for the efficient action of these muscles, indirectly gives great assistance in the progress of labour. It is this which causes a woman instinctively to arrest respiration, in order to admit of the efficient action of the diaphragm, and for the same reason she will eagerly employ the means which are afforded her, by towels tied to the bed post, or footstools in the bed, to fix the trunk, so as to bring the whole power of the expiratory muscles into play. A minor degree of voluntary expulsive effort, which is in all respects similar, is that which attends difficult defæcation. Haller attributed to the abdominal muscles the chief share of the expulsive efforts in labour, but that this is obviously wrong is shown by the fact that in feeble women, in whom the voluntary muscular system is very poorly developed, the delivery is not only effected as easily as in others, but actually, in many instances, with greater ease; and, moreover, complete anæsthesia, which has a most marked effect on the voluntary muscles, scarcely affects in any marked degree the progress of delivery. Another auxiliary force exists, in an advanced stage of labour, in the action of the muscles which constitute the floor of the pelvis, and in the contraction of the muscular fibres which enter into the composition of the vaginal walls. In the lower animals, as is well known, the comparatively feeble contractile efforts of the uterine cornua bring the young successively to the os uteri, when, powerful and violent propulsive efforts being awakened in the vagina, they are promptly expelled. In those animals, therefore, we may look upon the vagina rather than the uterus as the great organ of parturition. What occurs in the human species is precisely similar, only that here the vaginal contraction is subordinate to the uterine, while in rabbits and such like the converse is the case. That the vaginal expulsive force is by no means inconsiderable is shown by the manner in which the placenta is expelled, and still more, by what involves a more powerful muscular effort—the expulsion of the head in cases of presentation of the breech. In regard to the share which is taken by the muscles at the floor of the pelvis, this, too, is in all probability considerable, and constitutes, no doubt, the "reflected force" of which Solayrés de Renhac speaks in his admirable essay.

The Stages of Labour.—Writers, in considering the physiological phenomena of labour, have uniformly adopted the plan of dividing its progress into various stages. Some have multiplied these stages to an extent which is absurd, as the subject is thus rendered more perplexing instead of being made easy of comprehension to the student. The familiar classification of Désormeaux, according to which labour is divided into three stages, is that which is adopted here.

1st Stage. From the beginning of labour until complete dilatation of the os uteri is effected.

2nd Stage. From full dilatation of the os till the birth of the child.

3rd Stage. The complete separation and expulsion of the placenta.

First Stage.—In considering this stage, some little difficulty is experienced in determining the exact moment from which labour is to be dated. Long before symptoms of actual labour manifest themselves, certain preliminary processes are gone through, and to this some writers have with propriety attached the name of the Preparatory Stage. The falling down of the womb, which occurs in the last weeks of pregnancy, may be mentioned as perhaps the earliest of those changes. This, as has already been stated, is usually attended with a marked relief of such symptoms as arise from pressure upwards; but these are often replaced by such as are the result of pressure in the contrary direction, so that dysuria and irritation of the lower bowel now become familiar symptoms. If an examination is made at this period, the head will be found to have descended in the pelvis, and the condition of the os characteristic of the stage of pregnancy will at the same time be disclosed. The ligaments also of the pelvis become more relaxed and elastic, and the articulations somewhat less firm. The first contractions of the womb at the commencement of labour are either painless, or accompanied with discomfort so slight, as scarcely to attract the attention of the patient. Even thus early, however, the contractions may be perceived by the hand of the accoucheur, if he make an examination through the abdominal walls, and they are often accompanied with such an amount of pain as to lead a woman who has previously borne children to look for the speedy occurrence of labour.[1] It is by no means a rare occurrence for this class of pain to recur again and again, night after night, keeping the patient in a constant state of expectancy and apprehension. Usually, however, the period soon arrives when the pains become more severe, and return at regular periodical intervals, when the contractions, as observed through the abdominal walls, will be found to be much firmer than those of the earlier period.

Labour Pains.—A "Pain" in midwifery is used as synonymous with the expression "contraction," the one symptom depending directly upon the other. When, at the commencement of labour, the uterus is thrown into contraction, the cervix being, as we have seen, first affected and then the fundus, the muscular fibres, after remaining in a state of contraction for a brief period, relax,

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[1] These early contractions are far from being the first which occur. Indeed, it is well known that painless uterine contractions occur from an early period of pregnancy, and are often caused by the pressure of the hand through the abdominal walls, when they may be recognised with ease, and constitute, indeed, under such circumstances, special evidence as to the tumour being uterine. No other tumour contracts under the hand in a similar manner.

—as is usually the case in non-striated muscle, it being only exceptionally capable of sustained effort. During the whole period of a healthy labour, therefore, pain and pause alternate, the former being at first of short duration, and coming on at long intervals; but as the case progresses, the pains become longer and more severe and the pauses shorter and shorter, until, at the final effort, one pain succeeds another with such violence and rapidity that the periods of rest or pause are almost obliterated. When a pain comes on, it may in many cases be observed that the fundus, which is usually displaced to the right, moves toward the middle line, so as to bring the expulsive force to act in the direction in which it can be most efficiently employed. If we at this stage make a vaginal examination, we find, in primiparæ, that the os and cervix are so far obliterated, that the margin of the former is a thin, circular, and almost membranous ring, which represents that portion of the uterus. Against this apparently unyielding ring, the membranes are firmly pressed during the continuance of a pain; and as the amnionic fluid necessarily takes the direction in which there is least resistance, it is found that at this moment the difficulty of reaching the presenting part is increased by the augmentation in the quantity of the imposed stratum of liquid, and by the tension to which this gives rise. Soon, however, the rigid margin becomes softer and more tumid, a condition which, in pluriparæ, exists from the first, and the os yields slowly under the influence of successive pains, so that we are able during the intervals of perfect rest, to hook the finger into the os, and to feel distinctly the presenting part.

Effect on Maternal and Fœtal Pulse.—It is interesting to observe the effect which is produced on the mother's pulse by the occurrence of a pain. If, placing a finger upon it, we note, during an interval of rest, the number of beats, and continue the observation, we shall find that, with the commencement of the pain, its frequency is increased, and that, continuing to rise, it attains its maximum along with the pain; while with its subsidence, the pulse falls, and on its complete cessation is found to have returned to its original rate. This observation, as Hohl points out, may be usefully employed as a test to gauge the efficiency of the pains, for the more marked and rhythmical this variation of the pulse, the more effective is the pain which it at once accompanies and indicates. "When, however," he says, "the rapidity of the beats subsides before approaching the maximum, the pain is too weak; or when the rapidity rises by sudden starts, the pain is a hurried one, and in either case its effect will be imperfect." He assumes that, in an efficient pain of average duration, the increase and diminution of the pulse for each quarter of a minute may be put down as follows :—

18. 18. 20. 22 : 24. 24. 22. 18.

It would thus appear that the frequency of the maternal pulse attains its maximum during the first half of the second minute : but it must be understood, in making observations based upon this, that it applies to average pains only, and that towards the termination of labour, when the systemic excitement is intense, the pulse from that cause is often so accelerated that any observation of the kind is impossible. If auscultation be practised during the pains, we often find that the fœtal pulsations are somewhat accelerated, but the effect of a pain tends rather to obstruct than to facilitate the observation of the fœtal heart. The uterine souffle, however, undergoes, almost invariably, marked modifications. The situation having been ascertained at which that sound may most distinctly be made out, auscultation is sustained during the continuance of a pain, or of a succession of pains, when the following modifications are observed. The approach of a pain is heralded by a rushing sound, which may indicate muscular action, movement of the amnionic fluid, or movement of the child. Along with this, there is a marked increase in the distinctness of the souffle, which is raised in tone and in pitch, and may even become vibrating or musical. Up to a certain point this increases in intensity ; but, as the pain approaches its acme, the sound becomes as it were more and more distant, and then —when the moment of greatest contraction is attained—very faint, or altogether inaudible ; while as the pain goes off, it passes again through those changes in an inverted order, until the tone proper to the period of rest is restored.

False Pains.—We must be prepared in every case for the occurrence of pains which are thus named, in which, although there may be uterine contraction, it is not of a proper kind. The pain in such cases may be severe enough, but it is spasmodic and variable in character, and, instead of beginning in the cervix and extending upwards, as in a true labour pain, it commences usually in the fundus or body, and is attended with no symptoms indicating progress towards delivery. These pains, which are referred to the region of the fundus, and not to the loins as in normal labour, probably depend upon some irritation, having its origin, in a large proportion of cases, in some derangement of the digestive system. The leading characteristics, then, of what, for the sake of distinction, we call True Labour Pains, are uterine contractions, which commence at the os, and thereby prevent, by the constriction of its sphincter fibres, the descent of the umbilical cord, or of such parts of the fœtus as might impede delivery. These contractions are accompanied with pains, which may begin in front and pass round to the sacrum, but which are generally referred mainly to the lumbar and sacral regions.

From an early stage of labour, the tissues are prepared for their new function, by a profuse secretion from the vagina and cervix of a thick colourless mucus, while the parts from which it flows become softer and more cushiony. This discharge, which is occasionally tinged with blood, is frequently mixed with little semi-solid albuminous masses, and is very obviously provided by nature for the purpose of lubricating the parts, and thus facilitating the progress of the fœtus along the canal through which it has to pass. Upon the quantity of this secretion, the ease of the labour undoubtedly depends in no small degree; not by its lubricating action alone, but because its appearance involves a softening and general preparedness of the tissues, dependent upon the unloading of the congested vessels. There is no sign indicating the probable duration of a case of labour, upon which the accoucheur looks with more confidence than this; and from a copious secretion and relaxed condition of the parts, he augurs an easy and speedy labour, while from a dry, constricted and rigid vagina, he learns that in all probability a lingering exhausting labour will lead to a tardy delivery.

Mechanism of Dilatation.—The phenomenon which essentially attaches to that stage of labour which we are now considering, is the dilatation of the os and cervix, and it has, on that account, been called by some the "Stage of Dilatation." From what has already been said with reference to the nature of uterine contraction, it is evident that the effect of each individual pain, when efficient, must be to contribute to the opening or dilatation of the os. And, further, it must be obvious that, while the membranes are intact, the presenting part of the child can play but a trifling part in the mechanism of distension. The more attention we give to this subject, the more must we admire the admirable adaptation of means to an end which nature has in this instance adopted, where the object is, as we must remember, not only the expulsion of a solid body through a certain channel, the integrity of which must be preserved, but its expulsion in such a way as may least endanger its independent vitality. It is for that purpose, doubtless, that the membranes are thus preserved.

The first efficient contractions having probably resulted in an opening of the cervix to a trifling extent, and the tissues being sufficiently relaxed to admit of satisfactory progress, we are enabled to trace the process of dilatation through all its subsequent stages. When the os has so far yielded, the membranes, which are here separated from their uterine attachment, commence to protrude in the form, first of a watch glass, and then of the extremity of a pouch or bag, which has been termed the "bag of waters." Following the operation of a very obvious law already alluded to, this phenomenon implies, primarily, an attempt, on the part of the waters, consequent on the uterine contraction, to escape in the direction in which resistance is least. The special function, however, of this bag is to effect the further dilatation of the os, and we can conceive no means which could be more admirably adapted to this object than the graduated fluid pressure which is thus brought to bear upon the os equally in its whole circumference. It constitutes, in fact, in its action during a pain, a hydrodynamic force acting at once safely and powerfully upon the whole of the os. But another effect of this action is of even higher physiological interest, for in it we observe a means by which the head of the child is protected from all pressure during the first stage. If we make an examination, in the interval between the pains, when the os is moderately dilated, we can generally feel quite distinctly, through the membranes, the head, or other presenting part, and are able to distinguish, for example, the different sutures and fontanelles. A pain then comes on; but, instead of the head being driven downwards against the still rigid os, it recedes, and the bag of waters takes its place in effecting that dilatation which, when premature rupture of the membranes occurs, must of necessity be performed by the head itself. And the result, when that occurs too early, is, as every one knows, protracted labour and increased risk to the child. As the termination of the first stage approaches, the protrusion of the bag of the membranes becomes more and more marked; and as, at the same time, the pains usually become more violent, it often excites our astonishment that rupture is so long delayed, and we look for its occurrence at every pain. The bag by this time forms in the vagina a tumour of considerable size, and, in some cases, where the membranes are unusually resistant, this tumour completely fills the vagina, and even protrudes externally,—a condition which, as we shall have occasion afterwards to notice, may constitute a serious impediment to delivery.

This purely mechanical force, although we believe it to be the chief, is certainly not the only one which is brought to bear in the course of the process of dilatation. For we cannot doubt that it is powerfully assisted by the contraction of the longitudinal fibres of the uterus, which tend to drag the margin of the os upwards at the same time that the fluid is being forced downwards, overcoming in this way the resistance of the circular or sphincter fibres, the action of which constitutes a special resistance to the advance or protrusion of the membranes. In cases in which rupture of the membranes precedes dilatation of the os, the mechanism of the act is somewhat different, as in that case the walls of the uterus are brought to act directly on the surface of the fœtus, the head being forced, at each pain, against the circumference of the os, which, at some risk, and by a slower process, is thereby dilated.

Rigor.—A very frequent occurrence on the termination of the first stage is a Rigor. This is a symptom which might very naturally excite alarm in the mind of a young practitioner, more especially as it is sometimes so violent as to shake the bed on which the patient lies. It is, however, attended with no diminution but, on the contrary, by an increase of temperature, nor is it in any way affected by the application of warmth to the surface. This rigor is in fact a purely physiological phenomenon, and is similar to what is observed upon dilatation of the other sphincters of the body, a familiar example of which is afforded in the shudder which sometimes passes over the body during the act of micturition.

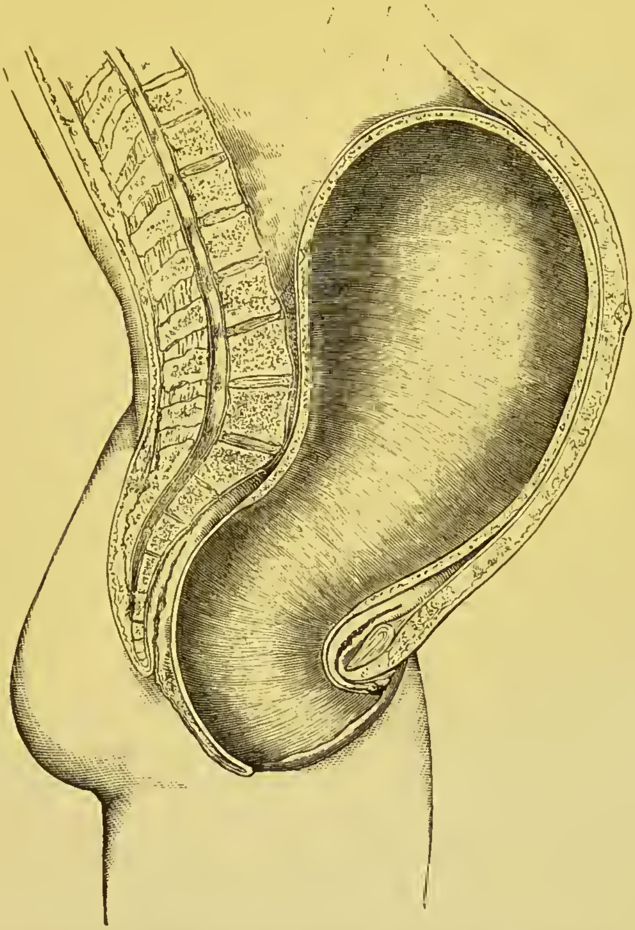
"Show."—Another familiar symptom is the slight discharge of blood which about this time commonly occurs, the ordinary mucous discharge being mixed, or at least streaked with blood which proceeds from the rupture of small vessels in the os consequent upon its extreme distension. This is what midwives call a "Show."

Rupture of Membranes.—But the crowning act of the first stage is rupture of the membranes, which usually occurs at the height of a pain, and is accompanied with a sudden gush of liquor amnii, usually propelled with considerable force, and with a sound which is often quite audible to the attendants. If this gush of water coincides, as it usually does, with complete dilatation of the os, it marks the termination of the first stage. Complete dilatation of the os must not be held at this stage to imply that obliteration of it which converts the parturient canal from the fundus uteri to the ostium vaginæ into a continuous tube, as shown in the figure which follows, for it is not till the second stage is well advanced that such an amount of dilatation is effected. Full dilatation at the termination of the first stage means merely such as will permit of the further progress of the head.

The pains which accompany the first stage are of a character peculiar to themselves, and are of a more teasing, worrying, and wearing nature than the more severe agony which subsequently occurs. The chief annoyance that the woman feels is from the fact that she fancies she is making no progress, and this stage is, therefore, often wearisome to her, and tedious in the extreme. She questions her attendants again and again as to the probable duration of her suffering, but this is a point in regard to which we should be specially cautious in risking an opinion.

Nothing is so likely to mislead us in this respect as the apparent intensity of the pain. For not only do certain women bear pain better than others, but the same degree of uterine contraction may, in individuals of different nervous susceptibility, produce a very different amount of actual suffering. Moreover, for reasons which we shall presently explain, the audible expression of suffering attracts more attention in this case, the pains being on that account sometimes described as the "crying pains." The seeming intensity of the pain, therefore, is not always in proportion to the degree of contraction, and still less is it to be held as a safe indication of its efficacy.

Fig. 111.



Parturient Canal completed by the Obliteration of the Os and Cervix.

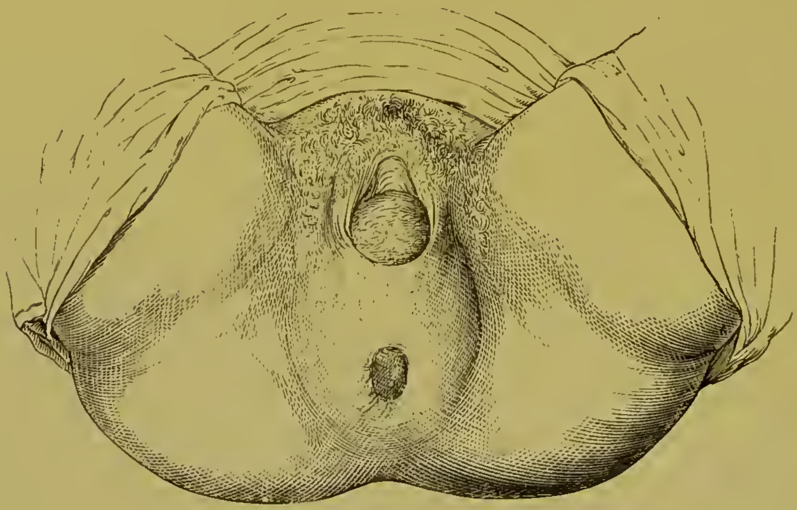
The duration of the first stage varies exceedingly, both in primiparæ, and in those who have had several children. Considerable difficulty in determining this point arises also from the impossibility of fixing the exact period at which this stage may be supposed to commence.

Assuming it, however, to date from the first sensible contractions, we may assume that, with ordinary pains and a normal condition of the parts, full dilatation may be effected on an average in about six hours, the time in primiparæ being somewhat longer than in other women; but the stage may nevertheless last for one hour only, or for twenty-four, without the occurrence, in either case, of a single symptom to cause us the least anxiety. It has been observed by the most experienced accoucheurs that, in those instances in which the first stage is tedious, the subsequent stages frequently proceed with unusual rapidity. Sometimes, cases in which there is unusual rigidity of the neck of the womb come to an unexpected and rapid termination in consequence either of rupture of tissue or of sudden relaxation of the sphincter fibres.

Second Stage of Labour.—Upon the termination of the first stage, the uterus gathers itself for further effort by tonic contraction around the body of the child. The pains now undergo a remarkable change. Not only do they continue to increase in frequency, duration, and severity, but the whole character of the pain is altered. The woman has now a consciousness of a solid body which has to be expelled, and she therefore brings to bear upon it, half involuntarily, the action of all such voluntary muscles as she has at command. The contractions, at the same time, although actually more severe, are much more easily borne,—and apparently for this reason, that the woman is now conscious that progress is being made. These are well termed "*bearing down*," or expulsive pains, and this stage has therefore been described by some writers as the Propulsive Stage of labour. Considerable resistance may still be offered by the os uteri, when rigid, to the advance of the head, and, if so, an œdematous swelling, which is limited in its circumference by the pressure of the os, forms on the presenting portion of the scalp, and may attain a considerable development. This is called the "*caput succedaneum.*" The anterior lip of the os may also become œdematous, in consequence of pressure between the advancing head and the pubis: but, as a rule, it slips up after a time, and the canal then becomes, for the first time, a continuous one. But it is usually not until the head has escaped from the embrace of the os, that the caput succedaneum forms, its size depending upon the degree of resistance which is offered by the perineum, and by the other tissues surrounding the ostium vaginæ. This swelling is always more marked in primiparæ, and its exact situation on the scalp depends upon the extent to which the movement of rotation, to be afterwards described, has taken place. We now find that when the head is forced down during a pain, the sutures overlap each other considerably, their situation being then indicated by a furrowed or wrinkled line on the scalp. The whole auxiliary force, formerly alluded to as residing in the abdominal and other muscles of expiration, now comes into play, and it is a wise provision of nature that, however low the head may stand in the pelvis, this seldom occurs until the dilatation of the os is complete; for we may be pretty sure that were it otherwise, laceration would be of more frequent occurrence. Every means which may in this way strengthen the expulsive effort is instinctively adopted. The respiration is arrested, the limbs are fixed, the cry ceases, and the woman presents the appearance of one who is undergoing a powerful muscular effort. It is usually during the height of the pain only that the cry ceases altogether, but even in women who make more noise than usual, the character of the cry is completely altered, and is clearly indicative of violent effort; indeed, so characteristic is this, that it is narrated of an old French accoucheur, that when he went to sleep while attending an accouchement, he was always roused from his slumbers by the altered nature of the patient's voice to a sense of his impending duties. The muscles of the floor of the pelvis, and the muscular fibres which enter into the composition of the vagina, aid still further the propulsive efforts; while the expiratory muscles are stimulated to redoubled energy by a reflex action starting from the sensory nerves of the vagina. There is every reason to believe, moreover, that the pressure exercised upon the uterus by the abdominal muscles, constantly increasing as the over-distension of their fibres is reduced, is a supplementary cause of the propulsive vigour of the uterus, which is, by the contraction of the former, more actively stimulated.

Violent, however, as the propulsive efforts are, they are not attended with that danger to the integrity of the parts which might, perhaps, have been expected; for, so soon as they reach such a point as would seem to endanger the latter, "the short gasp or cry is," as Tyler Smith says, "exchanged for a cry which dilates the glottis, and the pain and contraction subside. This cry is a motor action, excited by the emotion of pain, and instantly relieves the uterus of all extra-uterine pressure. Thus the glottis may be compared to a safety-valve, which is thrown open by emotion whenever the pressure becomes more than can be borne with safety." The presenting part, which now approaches the outlet of the vagina, soon presses directly upon the perineum, which bulges downwards; and, at the height of a pain, when this bulging is most marked, that part of the child which is to be first born, presents itself at the vulva. This is admirably shown in the accompanying engraving. (Fig. 112.) The rectum now becomes flattened, and its sphincter dilated, so that any fæcal matter which may have been lodging there is unavoidably expelled. The margins of the anus being dragged apart, the anterior wall of the rectum is exposed, and thus becomes, as it were, a temporary portion of the perineum, as is shown in the figure, while the perineum itself becomes more and more distended, for which modification, indeed, its structure, and the nature of the attachment of its muscles, admirably adapt it. The hæmorrhoidal veins are frequently much distended, and the dilatation of the perineum goes on both longitudinally and transversely, in a progressive manner, proportionally to the violence of each pain, with which the perineum projects as far as is safe; while, on the subsidence of the pain, the elasticity of the perineal structures causes the head again to recede.

Fig. 112.



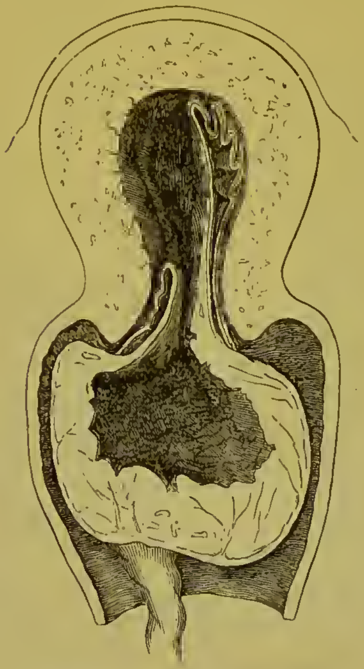
Distension of the Perineum. (After Hunter.)

Alternately advancing and retiring in this way, but always gaining ground, the head ultimately passes the distended aperture in a direction forwards under the pubic arch, the perineum now presenting an appearance almost membranous. In many cases, the head is arrested by the cessation of a pain, just at the moment when its greatest diameter is encircled by the circumference of the vulva, but it does not now recede. This has been called the stage of "*crowning*," and may be looked upon as favourable to the integrity of the soft tissues. A final pain now brings the presenting part into the world, and this period, which immediately precedes delivery, is that at which the suffering of the woman reaches its highest pitch—sometimes amounting to frenzy—and it is wisely and mercifully provided, in some codes of jurisprudence, that any act of violence committed at this moment is viewed with special leniency. Upon the birth of the head, the woman enjoys a brief interval of relief, but the pains soon return, and complete the delivery of the remainder of the child. The external parts, which have become contracted around the neck upon the passage of the head, are again dilated, and the shoulders are expelled. It will be found, however, that it is not the anterior shoulder, as is stated in many works, which is first expelled, for, in the majority of instances, it is that shoulder which lies towards the perineum which takes precedence in its passage into the world. During this stage, a slight amount of laceration generally takes place, in the direction of the distended perineum, and in primiparæ indeed the fourchette seldom, if ever, escapes. The remainder of the infant then passes, and with it a gush of blood and the rest of the amnionic fluid. The uterus now contracts firmly on the placenta, and may be felt, as a hard globe, above the symphysis, while the abdominal walls become flaccid, and the mother experiences a feeling of calm and perfect rest, which yield to her, from the comparison, a sensation of delicious repose.

Third Stage of Labour.—The final contractions of the second stage are sometimes so violent as to expel the Placenta along with the child. This, however, is an unusual occurrence, and what generally takes place, when the case is absolutely left to nature, is as follows:—The child, on its birth, remains connected with the placenta by means of the cord, which, for a time continues to pulsate. The latter being cut and secured in the manner to be described in the following chapter, the woman remains at perfect rest for an interval of about ten minutes or a quarter of an hour, on the average. The uterus then begins spontaneously to contract upon the placenta, the expulsion of which organ constitutes the Third Stage of labour. The pains of this stage, although of the same expulsive nature as those which preceded it, are comparatively trifling, and are accompanied with more or less of the blood which has escaped from the ruptured utero-placental vessels. They were, on this account, designated by the older writers *dolores cruenti*. A few of these contractions generally suffice to effect the complete separation of the placenta and its propulsion into the vagina, but the feeble contractile power of the latter often renders it necessary to give some assistance in the delivery. The placenta and the adhering membranes being expelled, this final act terminates the labour.

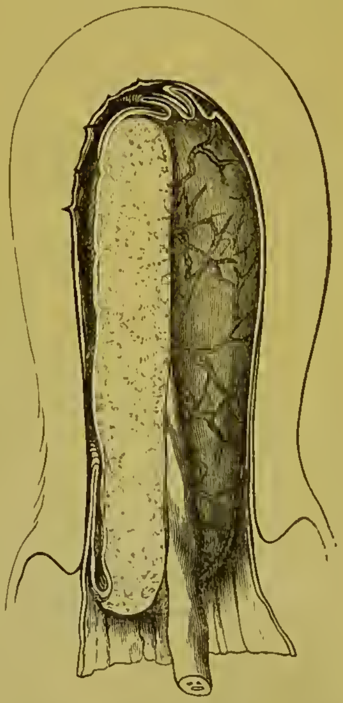
The description originally given by Baudelocque as to the mechanism of the birth of the placenta, has been adopted by most authors, and the demonstration which is given of it by Schultze in his Wandtafeln (see Fig. 113), is in every respect confirmatory of the views of the great French obstetrician. The idea of the process conveyed by them is, that the placenta passes through the vagina inverted, with its fœtal or amnionic surface turned outwards, an assertion which, in so far as the *natural* process is concerned, is quite incorrect. That the placenta passes, in a large number of cases, in the manner shown in Fig. 113, is probably true enough, but the reason is, that the practice of pulling on the cord is resorted to with too great frequency in general practice. For if we believe that the normal process is thus represented, it will seem rational enough, when delay occurs, to pull gently towards the ostium vaginæ that portion which nature intends should first be born. In cases, however, which are left entirely to nature, it will almost invariably be found that it is not the fœtal surface but the edge of the placenta which presents, and it is this part, overlapped it may be by the membranes, which will be found to pass first both into the vagina and through the vulva. This is the description which has been given by Lemser, Cazeaux, and some others, and, more recently, Dr. Matthews Duncan has, in a paper distinguished by his usual ability, put the matter in a perfectly clear light. In his drawing (Fig. 114), which we here reproduce slightly modified, the placenta is shown folded upon itself, with the detached uterine surface turned towards the observer, "but the folds are," as he observes,

Fig. 113.



Alleged Inversion of Placenta in the Third Stage.

Fig. 114.



Normal position of the Placenta in the Third Stage.

"according to the length of the passage, not transverse to it, as inversion or presentation of the fœtal surface imply." We are fully persuaded that the observation of half a dozen cases, in which no interference with the cord is permitted, will convince any one of the truth of these assertions. It will be shown presently that they involve some points of practical importance.

The uterus may now be felt firmly contracted behind the pubes, and on the maintenance of a certain degree of this contraction depends mainly the safety of the woman from the dangers of post-partum hæmorrhage. It frequently occurs, however, that the rhythmical efforts persist, when the womb may be felt in alternate stages of relaxation and contraction, without necessarily any particular loss of blood.

CHAPTER XVI.

MANAGEMENT OF NATURAL LABOUR.

Duties of the Accoucheur.—Preliminary Arrangements.—False Pains and their Treatment.—Armamentarium of the Accoucheur.—Position of the Woman during Labour.—Digital Examination : Points to be Examined.—Examination by Palpation.—Management of the First Stage.—Preparation of the Bed, &c.—Abdominal Muscles to be called into play during the Second Stage.—Management of the Anterior Lip of the Os.—Obstacles arising from Rigid Os; and from non-rupture of Membranes.—Use of Stethoscope.—Views regarding Support of Perineum: Treatment if Laceration is threatened: Causes of Laceration.—Birth of the Head.—Passage of the Trunk.—Treatment of Suspended Animation in the Child.—Ligature of the Cord.—Management of the Third Stage: Credé's Method.—Application of Abdominal Bandage.—Treatment of the Woman after Delivery.

Having in the last chapter fully considered the various phenomena attendant upon natural labour, the subject of the duties of the accoucheur remains for our consideration. It is fortunate that, in a very large proportion of all cases, the various stages of labour are effected by the unaided efforts of nature, in a manner which renders any "assistance" on the part of the accoucheur, in the ordinary acceptation of the term, quite unnecessary. Indeed, the duties which he has to discharge might, in nineteen cases out of twenty, be performed as efficiently and perhaps more agreeably to the feelings of the patient by a thoroughly trained and intelligent nurse. But, in the twentieth case, something may occur—and, it may be, quite unexpectedly—which suddenly demands special experience, operative skill, and a thorough practical knowledge of the healing art. It is only, however, as has already been observed in the introductory chapter, by a careful study of the normal process, that it is possible for us to recognise speedily and with precision deviations from the physiological standard, and this reason alone would suffice as an apology for a branch of practice which some look upon with disdain. But a more important reason still is to be found in the fact that many of the dangers and complications of labour arise so suddenly that, unless aid is at hand, the life of mother or child, or of both, may be sacrificed; for, as at present trained, it is rare to find a nurse who has the skill requisite for the management even of the more remediable complications of midwifery.

There are numerous points of detail which contribute greatly to the comfort of the patient, in regard to which an intelligent nurse is usually well informed, and the management of which may be left in her hands, if we have confidence in her ability. This, however, manifestly applies only to the wealthier classes, who alone can command the services of such skilled attendants; but, as the practice of the great majority of professional men extends, more or less, in directions where they have themselves to discharge many of the duties which are more properly those of the nurse, it is necessary that every young practitioner should thoroughly understand what these are. And, in any case, the failure of the nurse may devolve these duties upon him, so that it is of further importance that he should be familiar with them, in order that he may be able at once to detect incompetency and to remedy its defects.

Preliminary Arrangements.—The management of labour includes certain preliminaries, in regard to which women, and more especially primiparæ, often require some advice. The systematic neglect of the bowels which women so often practise, is likely, if persisted in, to be a cause of much discomfort. A pregnant woman should therefore be enjoined on no account to neglect this function as the period of labour approaches. In most cases, it is proper, by a laxative given at the outset of labour, or by the administration of an enema, to make sure that the lower bowel is empty; for, if this be neglected, the labour will be much more disagreeable to the accoucheur, and may also be unduly protracted. If her health be tolerable, she must not be encouraged to consider herself an invalid, but should be recommended to take such moderate exercise as may seem appropriate, while the tone and general vigour of the system is maintained by a sufficient diet, which may be generous, but not stimulating. During the last weeks of pregnancy, the descent of the womb often renders a woman more capable of moving about, from which "it would almost seem," as Rigby says, "that nature intended she should use exercise at this period, and thus prepare her, by increased health and strength, for a process which requires so much suffering and exertion."

False Pains.—The perverted and irregular contractions, to which we have already alluded under the name of "false pains," may cause the summoning of the accoucheur long before his services as such are required. Such pains may or may not depend on uterine contraction. In many cases, strict investigation will enable us to refer them to derangement of the bowels or to some similar irritation starting from another source; and, in those cases, the success of the treatment will depend upon an intelligent appreciation of the cause. But, should actual contraction of the muscular fibres of the uterus be a factor in the case, it will be found that the pains are abnormal in their character, beginning possibly in the fundus instead of the cervix. They seem to be absolutely without effect in advancing the progress of the labour, and a very characteristic feature is that they are referred for the most part to the hypogastric, rather than, as in normal pains, to the lumbar region. By mistaking false for real pains, we may, in our ignorance, allow the woman to go on suffering that which we generally have it in our power to alleviate. An enema or mild laxative in the one case, or an opiate in the other, will often suffice to give complete relief.

The practitioner will often, to his great annoyance, be called to the bedside of his patient, when, although labour may have commenced, the period is yet distant at which his services will be required. Such a summons should, however, be promptly obeyed. For although, in most cases, it will be time lost, it is of the greatest possible importance that anything abnormal should be detected as early as may be in the course of labour. We are then in a position leisurely to determine our plan of procedure, and, should any operative assistance be required, to select that period for it which is most favourable in the interests of mother and child. We are able, moreover, when we have an early opportunity of examining the case, to form an opinion, to which experience will lend confidence, as to the probable duration of the case, and this enables us to leave the patient for a time, and to attend to such other of our professional duties as may be most urgent. If the symptoms are such as to convince us that the woman is really in labour, we should always make an examination before leaving. In proposing this, especially in women who are in labour for the first time, we should never forget the consideration which is due to the feelings of the patient, whatever be her rank in life. For it cannot be otherwise than that a woman must look upon such an examination as is necessary, by a person of the other sex, with apprehension, if not with abhorrence; but if the necessity be first explained to her in a few kindly words, she will rarely fail to appreciate the good feeling which prompts them, and will submit without a murmur to whatever may be deemed essential to her safety or comfort. A similar feeling should guide us in everything we do in the practice of midwifery, and if so, we shall seldom fail to win the confidence of our patient. To lay down, however, as some have attempted to do, rules for the guidance of the young practitioner in this respect, is simply absurd; for, to tell a man of grave demeanour to look cheerful, and a man of lively and jocund spirit to look grave, is to make both artificial, and more like fools than rational beings—a state of matters little likely to establish confidence or to engender esteem.

Obstetrical Armamentarium.—There are certain articles of his armamentarium which the accoucheur should look upon as indispensable, and should therefore carry with him as a matter of course: these are an elastic catheter, a small phial of some approved preparation of opium, and a similar quantity of the liquid extract of ergot. To these may be added chloroform and sal-volatile; and, if he is going to any distance, he should certainly take the forceps, of which it may be said that, while it does not occupy much space, its absence may possibly cause many hours of delay and increased danger. It is the duty of the nurse to provide narrow tape or strong thread for tying the cord, and to have in readiness the abdominal bandage, scissors, hot and cold water, and a supply of napkins; but, as it will often fall to the lot of the medical attendant to see to these preparations himself, he should, at least, be provided with such material as may be depended upon for ligaturing the cord; and we take it for granted that he habitually carries with him scissors and a stethoscope. For obstetric use, a stethoscope with an elastic stem is to be preferred. He should also give a general glance around, and see that everything is ready which may be necessary for the comfort or safety of the patient.

Digital Examination.—In making an examination, the most convenient position for the accoucheur, as well as the patient, is that which is invariably adopted in this country. The woman lies on her left side, with her back to the examiner, and near the edge of the bed, which must, if necessary, be previously so arranged that her head corresponds to his left hand.[1] The index and middle finger of either hand—the right being usually preferred, although the left has certain advantages—being then smeared with lard or oil, are passed over the perineum, and gently into the vagina up to the os uteri. It is usual to select a period of a pain for the examination; but, if so, the finger must not be withdrawn until we have examined the parts in the state of repose also, for the protrusion of the bag of waters during a pain makes it impossible to ascertain the presentation, without risking premature rupture of the membranes by undue violence. The points which one ascertains in the course of the examination are, in the first place, the state of the vagina, whether it is soft, relaxed, and well lubricated with mucus. In regard to the os uteri, we observe if it is soft and dilatable, or rigid and

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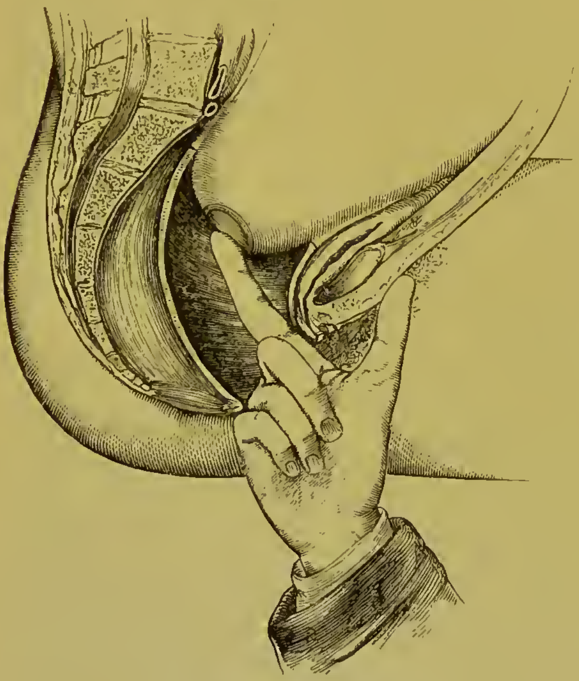
[1] "In the earliest periods of history, women appear to have been delivered in a sitting posture, as is described in the first chapter of *Exodus*. This mode was revived in comparatively modern times; thus Ambroise Paré, in 1573, speaks of a labour-chair, with an inclined back, which he preferred to a common bed. Labour-chairs were brought into very general use upon the Continent in the beginning of the last century by Deventer, and, although they have been in a great measure discontinued in modern times, there are still some districts in Germany where they continue to be used. It is a species of *chaise percée*, furnished with straps, cushions, &c., by which the patient can fix her extremities, and thus enable the abdominal muscles to act with the greatest power. In some remote parts of Ireland, and also

Fig. 115.



Mode of Digital Examination.

of Germany, the patient sits upon the knees of another person, and this office of substitute for a labour-chair is usually performed by her husband. Labour-chairs, as far as we are acquainted with their history, were never used in this country, nor have they been used for the last century in France, where the patients are usually delivered in the supine posture, on a small bed upon the floor, which has not inaptly been termed *lit de misère*. A modification of the labour-chair is the labour-cushion, first used by Unger, and afterwards by the late Professor von Siebold of Berlin, and Professor Carus of Dresden; it is a species of mattress, with a hollow beneath the nates of the patient for receiving the discharges which take place during the labour. The patient is compelled to lie upon her back during the greater part of labour, and thus maintain the same position for some time, which must necessarily become irksome, and even painful to her. In this country and in Germany, the patient is delivered upon a common bed, prepared for the purpose as above mentioned; in England she is placed upon her left side, the nates projecting to the edge of the bed, for the greater convenience of the accoucheur; in Germany—except in Vienna and Heidelberg, where the English midwifery has in a great measure been introduced by Boer and Naegele—the patient is delivered upon her back. In former times, the supine posture was also used in this country, but for about a century the position on the left side has been preferred."—A System of Midwifery by Edward Rigby, M.D. London, 1844.

unyielding, and to what extent it has become dilated, if at all. Information is further obtained as to whether the membranes are ruptured, whether we have to deal with a natural presentation, and if there is any pelvic deformity or morbid growth which might impede the progress of labour. And, finally, we may thus recognise at an early stage prolapse of the cord, a condition which calls for constant care and anxiety so long as the labour lasts. With this view, also, it is usual to make an examination at the time of the rupture of the membranes, as it is at this moment that the loop of the cord frequently descends; moreover, an examination now enables us, more surely than before, to determine the position of the presenting part. The mode of examination above described is represented in the accompanying figure, in which the examination is being conducted with the right hand. In most cases one finger, as here shown, will suffice, and this should always be attempted when the examination seems to cause unusual pain. The student and young practitioner should avoid making too frequent examinations, for not only does this irritate the parts, but it tends to remove, at each successive examination, a portion of the lubricating medium, upon the quantity of which depends, in some measure, the satisfactory issue of the case. The practice of previously smearing the finger with some bland lubricant is resorted to on every occasion in which an examination is found to be necessary, not so much to facilitate introduction—which the abundance of mucus generally renders easy enough—as to supply the place of any mucus which may be removed, and in a certain class of cases to protect the finger. The operator should never omit, after an examination, to address a word or two to the patient in a cheerful tone; and, if the presentation be natural, and you are then able to say so, she will always be gratified by hearing that "all is as it should be."

Palpation.—Another and very important method of examination, to which considerable attention has been given of late years, particularly on the Continent, is by abdominal palpation. This is applicable, not only to the period of labour, but also during pregnancy, and is perhaps even more valuable in the latter case than in the former. Special experience is no doubt required to obtain reliable results; but, after some practice, surprisingly accurate results are often obtained, enabling us to ascertain under favourable circumstances, not only the presentation, but even the position of the child.

Management of First Stage.—So long as the os uteri is not fully dilated, or, in other words, so long as the first stage continues, the patient should be encouraged to believe that this is a stage which is merely preliminary to the act of parturition; and that, therefore, she should not lie in bed, but rather walk about in the intervals between the pains, and take such light food as she would under ordinary circumstances. If she can be induced to occupy her attention, as far as possible, by any familiar occupation, however trivial, it will be to her advantage, by relieving the tedium of her suffering. If this cannot be done, her attendants should try, by cheerful conversation, to beguile the time, and to divert her mind from the gloomy apprehensions which are of frequent occurrence at this period. The accoucheur should not remain in the room during this stage, unless there be any special necessity for it, although he may visit it occasionally. To do otherwise would encourage her to expect assistance at his hands, which it is not in his power to afford, and moreover his presence would to her seem to imply that he expected a speedy termination of her sufferings. During this period, the woman is frequently advised by ignorant attendants to press down, and with this view footstools are placed at the foot of the bed, and towels are tied to the bed post, by means of which she may fix the trunk, and bring the whole force of the expiratory muscles to bear. This acts most injuriously on the progress of the labour, for the stage is one of dilatation, and not of propulsion; and, if the muscles referred to are thus brought prematurely into play, the voluntary expulsive force is fruitlessly expended before the stage arrives at which it may properly be employed. Nothing, in fact, is more certain, than that any attempt, either on the part of the woman or on the part of the practitioner, by forcible dilatation of the os, the administration of ergot, or the exhibition of stimulants, to hurry delivery, must be strictly avoided in the course of the first stage of a natural labour. And, even in cases where its duration is prolonged far beyond the average, this of itself is no excuse for interference, unless the general symptoms indicate that it is our duty to accelerate the labour by such means as are within our reach—a state of matters which is of rare occurrence. When the pains flag, it has often been found that the administration of an enema for the purpose of emptying the lower bowel, acts as an efficient stimulant to uterine contraction.

The pains usually become more severe as the termination of the first stage approaches, and at this period it is advisable that the woman should go to bed, more especially if she has previously borne children, as there is a risk of the sudden propulsion of the child immediately upon the rupture of the membranes. Previous to this, the nurse prepares the bed—which should not be too soft—by placing over it a piece of india-rubber sheeting to protect it from the discharges. Upon this a folded sheet, about two and a half to three feet in width, is placed across that part of the bed upon which the pelvis of the woman lies. By this simple arrangement, the sheet may be gradually pulled through as it becomes soiled with successive discharges of liquor amnii, or of blood, and at the end of the labour it is completely removed along with the final discharges which accompany the birth of the placenta. The ordinary night-dress which the patient wears, or rather that part of it which is beneath her as she lies, should be rolled up above the waist, and the lower part of the body covered with a petticoat which opens all the way down, and she should then be covered with such bedclothes as the season of the year and her own feelings may render necessary. She lies on her left side, as has already been stated, with her back to the practitioner, and her head consequently to his left hand: and one of the advantages of such a position is that she is not disturbed by seeing such preparations as may be necessary for her assistance or relief. It is by no means essential that she should occupy this position continuously till the termination of labour, as this would be irksome in the extreme; so that she may be permitted to lie at will on either side, or on the back, reverting necessarily to the left side when any occasion may arise for renewed examination.

For reasons above stated, frequent examinations are always to be avoided. From time to time, however, they may be instituted with the view of ascertaining the rate of progress which is being made. This has the further advantage of allowing the busy practitioner to absent himself at intervals, for such a period as he judges to be quite safe; but, in this respect, he must always be cautious, as he will be blamed if absent at the critical moment. In some cases, even in primiparæ, a sudden and violent increase in the expulsive force unexpectedly occurs, when, if the parts be soft and dilatable, the birth may take place with extraordinary rapidity. All calculations as to the probable period of delivery are very uncertain, and although experience gives a certain confidence to the opinion which may be formed, we cannot be too cautious in expressing it; for, not only may it end abruptly, as we have seen, but, in other cases, labours, which up to a certain point have advanced in a manner which seemed to render speedy delivery almost a certainty, are suddenly suspended by failure of uterine action, or by some other cause. The child may, under such circumstances, actually be arrested on the very threshold of its entrance into the world.

Management of Second Stage.—So soon as rupture of the membranes has taken place, the sheet beneath the patient should be pulled by the nurse towards the edge of the bed, so that she may rest on a dry portion, and avoid the discomfort of lying on a wet bed. The stage of propulsion now usually commences, and it is quite proper now to encourage the woman to avail herself of the aid of the abdominal muscles. In most cases, she will do this instinctively, and require no instruction whatever; but, in others, there is a disposition to waste the force of the expiratory muscles in cries which are worse than useless, and it is in these cases that encouragement should be given. In regard to the means already referred to for fixing the trunk, the accoucheur will use his own discretion as to how far they are to be permitted; for, if the pains are of more than usual violence, we must rather restrain than encourage her efforts, while if, on the contrary, they are slow and inefficient, we may, with perfect propriety, allow of any means which may act by increasing the deficient propulsive force. At any time in the course of the labour, but more especially perhaps about the commencement of the propulsive stage, difficulty may arise from retention of urine, in consequence of mechanical closure of the urethra. This requires the use of the catheter, which is to be employed with caution and with due reference, as has already been mentioned, to the anatomical modifications which attend pregnancy. The pressure consequent upon the descent of the head, often gives rise to cramps in the thighs, a symptom which sometimes aggravates very greatly the suffering of the patient. We shall not stop here to consider whether this is due to direct pressure upon the large nervous trunks, or to a reflex action; but, in regard to the treatment of what is a troublesome complication, although not a dangerous one, it can only be said that, if emptying the bowels by an enema, and warm friction of the thighs, should fail to remove the spasm, we can but try such other means of palliation as may occur to us, for in all probability the patient will not enjoy complete relief, until the termination of the labour has removed the cause which is responsible for the symptom in question.

Œdema of Anterior Lip.—As the head descends in the pelvis, after the termination of the first stage, it not unfrequently happens that the anterior lip of the os becomes œdematous and swollen, indicative of pressure of the anterior uterine wall between the presenting part and the symphysis pubis. This constitutes a very manifest impediment to the progress of the labour. It has been said by some of the best authorities that under such circumstances we should never interfere. "All attempts," says Rigby, "to push it above the head are objectionable, because, in the first place, the finger cannot reach sufficiently high to effect the object, and, therefore, the swelling descends again to its former situation; and, secondly, the efforts to push it up only tend to inflame it, and increasing the swelling." To this we must demur. Any attempt, rudely or forcibly, to push up the anterior lip, even when it exists as a manifest impediment, should certainly be avoided; but we are bound to add that, in many cases, it may be pushed beyond the head with perfect safety, and in this way the impediment to delivery may be at once obviated. The swollen part should, during the interval between two pains, be gradually and cautiously pressed up as far as possible beyond the head. If the finger be removed, the tumour descends at once, as Rigby says; but, if it be kept in position until the next pain comes on, the head will often pass down, and the cervix be retracted upon it, precisely as occurs by the action of the levatores ani muscles at the moment of the passage of the head through the ostium vaginæ. This cannot be effected in every instance, but the attempt, if cautiously performed, is free from risk, and in a very considerable proportion of cases, is attended with complete success.

Tough Membranes.—The further progress of the labour brings the head, or other presenting part of the child, downwards, towards the floor of the pelvic cavity. In a certain number of cases, it is, however, impeded in its progress by mechanical hindrances, which it is in our power to remove. The membranes, for example, may be so tough as to have resisted an ordinary amount of force at the period at which they usually give way: or they may be distended by a very unusual quantity of liquor amnii; in either of which cases the bag of waters may constitute an impediment to delivery which can only be removed by artificial rupture, so as to permit the descent of the head.

Rigidity of Os.—In other instances, the os uteri presents a condition of abnormal rigidity, its margin being, at the acme of a pain, hard, rigid, and tender. In former times the practice universally adopted in such a case was blood-letting, and we do not for a moment doubt that the effect of the operation was to relax the rigidity, and permit the descent of the head, and the same remark may be made with reference to the administration of tartar emetic. We have, however, in chloroform or ether, agents far preferable, which, in such cases, exercise a most powerful influence upon the rigidity of the os. We should never fail to avail ourselves of these in cases requiring operative interference. In such instances, indeed, they fulfil a threefold indication, by subduing the rigidity we are speaking of, arresting voluntary movements, and allaying reflex susceptibility. Of late, chloral hydrate has been extensively used for the same purpose and with satisfactory results; and in France, belladonna has enjoyed a high reputation, though its efficacy is open to question.

The stethoscope should be employed from time to time during the course of a tedious labour, to ascertain the vitality and vigour of the fœtus, for there are cases in which the life of the fœtus may be compromised, while that of the mother undergoes no risk whatever. Some, indeed, have recommended that, in labours apparently the most uncomplicated, the stethoscope should be frequently used, so that risk to the life of the child may thus be reduced within the narrowest possible limits.

When the further progress of the case has brought the head to press against the perineum, as is shown in Fig. 112, it distends or bulges that structure outwards, or rather downwards, more and more during every succeeding pain, while the position of the patient on the left side enables us often to watch the process without her being aware of any exposure. The axis of motion is now no longer downwards, but forwards in the direction of the sub-pubic angle, as will be fully described in a subsequent chapter. A very usual practice, at this stage, is to separate the knees by means of a pillow or otherwise, so as to encourage, as far as possible, the movement in this direction. This has, however, been condemned by some of the best authorities, on the ground that labour should be habitually retarded at this stage, an argument, the force of which, we confess, we can scarcely admit. And this for two reasons: first, because the position on the side, which involves apposition of the knees, is unfavourable to movement of the head in the direction which we have indicated as normal; and, second, because, in a large majority of cases, the separation gives the woman great relief, a fact which is familiar to every experienced nurse.

Management of Perineum.—The most important point, however, connected with this stage of the process is, undoubtedly, the Support of the Perineum—a mode of procedure which is recommended in some form or other by most writers on obstetrics. Many years ago, our attention was, by an accidental circumstance, very particularly directed to this matter, and we published some time afterwards a paper on the subject,[1] which was founded not only on a careful clinical study of the phenomena of this stage of labour when unaided, but also on a critical examination of the views entertained by those who practised support of the perineum, and of the reasons which swayed them. The points brought out were mainly these:—

The earlier writers recommend only, in reference to this stage, the free use of lubricants and emollients. About the middle of the last century, Smellie advocated artificial dilatation of the external orifice of the vagina; Puzos, stretching of the parts along with lubrication; and Roederer, pressing of the perineum towards the sacrum; all these modes of treatment differing greatly from the modern procedure. To whom the practice of perineal support is originally due is a matter of doubt, but, in the treatise published by Professor Hamilton of Edinburgh, in 1781, we find it mentioned as a distinct system, applicable alike to natural labour and to that which is in any way abnormal. This author, like Puzos, advocates the use of lubricants, and recommends us to release the perineum when the head is being born, "by cautiously sliding it back over the face and chin of the child." From this time writers have, in the main, agreed that, by a support of the perineum, lacerations are to be prevented; but they have not agreed as to what "support" is, or to what extent it is to be practised. It would carry us far beyond the limits within which the subject must here be confined to examine critically the views which have been entertained by approved authorities on this point. We shall, on this account, refer only, and that very briefly, to the opinions which are promulgated by some of the authorities referred to.

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[1] Glasgow Medical Journal. January, 1860.

Dr. Ramsbotham says,—"As soon as the head has come to press on the external parts, it becomes our duty to take our seat by the bedside, and never to move from our position till the child has passed. This we do to protect the perineum and to prevent laceration." . . . "Place your elbow," he continues, "against the bedstead, regarding it as a fixed point, and allow the perineum to be forced against your hand." Fortunately there are few, if any, teachers of midwifery who go to such an extreme in the recommendation which they give to their students; for we believe that support of this kind can scarcely fail sometimes to bring about the very accident which we are striving to avert. Dr. Tyler Smith pointed out many years ago, that pressure upon the perineum is apt to excite the uterus to increased contraction by a reflex action starting from the nerves which are distributed through the former structure, and on this ground he dissuades us from practising systematic support. Churchill recommends very gentle and careful support, and, in concluding his observations on this point, informs us that it has been his lot to "witness more than one case where rupture was owing to excessive and injudicious support." Denman only sanctions support in first cases, while Naegele plainly says "under ordinary circumstances, any support of the perineum is unnecessary."

It was a careful study of these opinions among others, along with a thorough observation of the process in nature, which led us long ago to condemn support of the perineum as irrational and useless in all cases, and undoubtedly hurtful in some. It must be admitted, however, that the method usually adopted, which consists in very gentle support, with the view, mainly, of directing the head forwards, probably does no harm; the palm of the left hand, protected by a napkin, being laid along the perineum, and pressed against it during a pain. Two points must here, however, be borne in mind; that the perineum must sooner or later yield, and that support necessarily implies opposition to the progress of the head. If, therefore, we admit support as a rule of practice, we shall find ourselves opposing a natural process, and presuming to teach nature a lesson. If any one will but take the trouble in a single case to watch the admirable manner in which nature effects her purpose in dilating the perineum, each pain increasing the dilatation by a carefully graduated force, until at last the orifice permits the passage of the head, the observation will go further to convince the most earnest advocate of the doctrine of support than any mere argument can do. And be it remembered always, that rupture of the perineum will occur in a certain proportion of cases, do what we may.

The practice of perineal support, then, is, if very gentle, harmless. Indeed, we are inclined to admit that, in some cases of deficient contractile power, it may be beneficial, but in a way very different from what the operator counts upon—by exciting more energetic propulsive action. The practitioner, however, who never puts his hand to the perineum will, we firmly believe, have fewer cases of ruptured perineum in his practice than he who admits support in any form as applicable to every case of labour; while, if he adopts the advice of Ramsbotham, as above quoted, he will, beyond all reasonable doubt, increase the danger of rupture. We do not think, in reference to this subject, that we take an exaggerated view of the case in looking upon it as a relic of "meddlesome midwifery," in which we presume, by irrational and bungling interference, to dictate to nature.

The proper management of this stage—which will be found to be attended with results of the most satisfactory kind—consists in watching the amount of pressure to which the perineum is being subjected. This may be done effectively and easily by keeping a finger on the anterior margin of the perineum, which enables us, with a little practice, to gauge with tolerable accuracy the degree of propulsive force which is being exercised. Should this exceed the normal standard, so as to imperil the integrity of the tissues, we must then order all aids to expulsive effort to be removed from the reach of the patient, and at the same time encourage her to cry out lustily during the height of a pain, or, in other words, to make free use of the safety valve of the glottis. Should circumstances render it expedient to oppose the advance of the head, with the view of rendering the process of dilatation more gradual, this should be done, not by pressure on the perineum, but by pressure exercised directly upon the head of the child, which is to be pressed towards the hollow of the sacrum. But the effect even of such pressure is in most cases doubtful, and the greatest possible care must be exercised lest we divert the force which should be expended in the direction of the pubic arch, and, by bringing it to bear directly upon the perineum, thus enhance its risk of rupture.

In all first cases, the fourchette is slightly lacerated, but the rupture seldom extends further. In cases in which there exist morbid rigidity, cicatrices, or a diseased state of the parts, the rent may extend deeply into the perineum, and even, in extreme cases, through the sphincter into the anus. We must guard, however, against taking too serious a view of such a laceration, for what may seem at the moment of delivery to be a serious surgical lesion, turns out in the course of forty-eight hours, and in consequence of the retraction of the parts, to be but a trifling fissure. It is not, as a rule, by the passage of the head that the most serious lacerations are effected; they are often commenced by this, but it is the passage of the shoulders which extends the rupture. Sometimes, the perineum gives way under an amount of pressure which is comparatively trifling, suddenly yielding in its whole extent like a piece of wet parchment; and it is in these cases that a suspicion has arisen as to the possibility of disease in the structure of the parts. There is also an increased risk of perineal rupture in certain forms of pelvic deformity—such as diminution in the transverse diameter of the outlet. This involves an approximation of the tuberosities of the ischia, and an abnormal acuteness of the sub-pubic angle—conditions which obviously must make the head pass further *downwards* in the direction of the perineum, before it is possible for it to move *forwards* under the arch. Unskilful manipulation, with or without instruments, is also a fertile cause of perineal rupture. Certain rare cases are recorded in which the child has actually passed *through* the perineum, by forcing a passage through this structure and the anterior wall of the rectum, while the posterior commissure of the vagina remained unruptured.

Rigidity of the perineum is an affection which sometimes causes a very serious impediment to the completion of labour. If it be simple rigidity, unconnected with disease or cicatrices, and accompanied by dryness of the parts, the treatment applicable in the case of rigid os may be tried here also, for there is no doubt that in such a case, chloroform, ether, or chloral hydrate, would have a beneficial action; and there is no reason that we can see why, in such cases, the old-fashioned treatment by lubricants may not be useful. But there are cases in which rigidity is the cause of rupture; and, when the latter is impending, we may occasionally be justified in making a slight incision with the lancet, or tear with the finger nail if possible, on each side of the ostium vaginæ, as has been practised by some of the most distinguished accoucheurs. In this case, the laceration which attends the passage of the child is, both in direction and in extent, a matter of very little importance. This is an advice, however, that one is almost afraid to give to the inexperienced, as there is much risk of its being improperly and unnecessarily resorted to. Cases in which, in the absence of structural disease, rigidity in this situation constitutes an impassable barrier to delivery are very rare; but they do occur, and, when present, may require free incisions to permit of the passage of the child. The treatment of perineal laceration will be referred to in another place.

Threatened Asphyxia.—When the passage of the head is completed, we should ascertain if the cord is around the neck, and if so, it must be slipped over the shoulders, or pulled down so as to prevent injurious pressure. One hand is to be placed over the fundus uteri, which is to be gently pressed, and followed in its descent by the hand —a practice which tends to promote the speedy separation of the placenta. Unless there are symptoms of threatened asphyxia in the child, or circumstances which demand immediate delivery, we should not in any way interfere in the birth of the trunk, which will be naturally effected after a short pause, generally counted by seconds. We must now place the child in such a position as will enable it to breathe freely, the best evidence of which is a loud cry; and, should efficient respiration not immediately ensue, it will be our duty at once to adopt such means as are best suited to excite respiratory action. The stimulus afforded by exposure to the external air, along with certain centric causes arising from deficient aeration of the blood, are generally sufficient to excite the muscles which contribute to the act; but, should these fail, it will be proper, by blowing on the face, a smart pat on the nates, or sprinkling with cold water to set the function agoing without delay. Failing this, the infant should be plunged into a basin of warm water, and cold water plentifully dashed upon it as it is removed from the bath. The tongue should be drawn forward, the mucus rapidly removed from the fauces as far as is possible, and regular attempts at artificial respiration persevered in so long as the slightest action of the heart continues. In cases of suspended animation, the cord should not be tied until it has ceased to pulsate, as there is a possibility, in such circumstances, of a certain amount of placental respiration. The child is also threatened with asphyxia in cases where it is born along with the unruptured membranes, and thus remains, after its separation, enveloped in its intra-uterine coverings and bathed in the liquor amnii. In this case the membranes must be instantly ruptured, and aerial respiration established.[1]

Ligature of the Cord.—The infant being born, and having given proof of its independent existence, our next duty is to ligature and cut the cord. The material to be used as a ligature is a matter of no very great moment, provided it be of sufficient strength, some preferring strong thread, and others an agent which, while it compresses efficiently, is not so incisive as the ordinary surgical ligature, by which the gelatine of Wharton is actually cut. The material preferred by the latter is strong narrow tape, of which the narrow red tape of national tradition affords a good example. The ligature should be placed about two or three inches from the umbilicus, and should be drawn with sufficient tightness to prevent the possibility of oozing. The knuckles should be brought together, while the knot is being drawn, to steady the hands; for, were the ligature to snap, in the absence of this precaution, the funis might be torn from the umbilicus or its placental attachment, and thus give rise to much trouble and some risk. The reason for applying the ligature at such a distance from the umbilicus, is to leave room for another should the first fail. It is usual to apply a second ligature on the placental side of the first, and to cut the cord between the two; but the advantage of the additional one consists entirely in preventing the fluid contents of the umbilical vessels from further soiling the bed linen. In reference to this, Dr. Dewees, who disapproved of the application of a second ligature, observes that "the evacuation from the open extremity of the cord will yield two or three ounces of blood, which favours the contraction of the uterus and expulsion of the placenta." In the case of twin pregnancy, a second ligature should always be applied, as the cords occasionally communicate.

Third Stage of Labour.—The child being separated and handed to the nurse, there only now remains, to complete delivery, the Third Stage, or expulsion of the placenta. If, at the termination of the second stage, the directions above given have been observed, and the fundus has been followed by the hand and firmly compressed, it is seldom that difficulty will be experienced in regard to the speedy and satisfactory termination of the case. If we do not feel that the uterus is firmly contracted behind the symphysis, we may attempt by friction over the fundus to excite it to contraction; if, on the contrary, it is quite firm, the case may be left absolutely to nature, when expulsion will usually occur in from ten to twenty minutes. But what is, in its results, a much more satisfactory method of procedure is to keep the hand upon the uterus and, after a pause of ten minutes or so, to aid its contraction by means of firm pressure. This method of expression, or squeezing the placenta and membranes out of the womb, has long been practised, but fortunately, of late years, more particular attention has been directed to it under the name of "Credé's method," so that this mode of managing the third stage is now becoming—as it ought to be—very generally adopted. In this way, a very few minutes will usually suffice for the passage of the placenta, its ultimate emergence being effected by the action of the muscular fibres of the vagina and perineum. Pulling on the cord should, if possible, be avoided.

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[1] In this case the child is said to be born with a "caul." It is supposed to be indicative of good luck and prosperity, and in seaport towns the caul is carefully preserved, and is believed by the credulous to be a talisman which protects the wearer from death by drowning.

Should any unusual delay or special difficulty arise, it will then be proper to pass a finger into the vagina, using the cord as a guide, in order to ascertain whether or not the separation of the placenta is complete. When, with a single finger, we can reach with ease the insertion of the cord, we may infer that the placenta, or at least the greater part of it, is in the vagina, and under such circumstances we may attempt to hook down its edge, at the same time drawing gently on the cord. But when we find the cord passing up into the uterus beyond our reach, the edge of the placental mass which presents at the os uteri being alone accessible, we know that the placenta, although possibly completely separated, has not as yet been expelled from the uterus; and, after pausing for a few minutes, we again endeavour, by forcible compression applied to the fundus and sides of the womb—the fingers being directed to the pubes—to awaken the dormant uterine energy, to assist such pains as may be present, or to imitate them if absent. What is called Credé's method is to grasp the uterus firmly with one hand, so that the thumb is in front, while the tips of the other fingers are pressed as far as possible behind the posterior wall of the organ. It is necessary, however, in a certain number of instances, to assist nature further in the completion of the process. An intelligent apprehension of the manner in which the placenta is naturally expelled, which is described in the preceding chapter, will prevent us under such circumstances from doing what is too common in midwifery practice, viz., forcibly pulling on the cord. In a large proportion of cases, the delivery of the placenta may doubtless by this means be effected, it being hauled through like an inverted umbrella, but the amount of hæmorrhage, at the time and afterwards, may thus be very unnecessarily increased. The proper course is to pull down the presenting portion of the placenta, using only such traction upon the cord as may assist us in effecting this object. Our first efforts of extraction should be made in the axis of the uterus, backwards and downwards. This is to be altered, as soon as the placenta passes into the vagina, to a direction downwards and forwards, corresponding to the axis of that canal. Should we fail in this attempt, or should there be danger of a portion only of the placenta being removed, it will be proper to introduce cautiously the hand into the uterus to such an extent as may be necessary for the complete extraction of the mass; and, if it should then be found, as is sometimes the case, that morbid adhesions exist, these must be broken down in their whole extent, and the hand, if possible, not removed until the entire placenta is brought with it. Irregular contraction of the uterus may also prevent its expulsion, and of this a familiar variety is described as "hour-glass" contraction, the organ being retained in the upper segment by a constriction. In some cases, benefit is derived from continuous gentle traction on the cord, a procedure which acts, not in the way of forcible extraction, but by exciting the muscular fibres to expulsive efforts.

When the placenta is expelled, or has been extracted, it is well to look at its uterine surface, to see that no portion of it has been left behind; and it is also of importance, as it escapes from the external parts, that the adherent membranes should pass along with it, as otherwise a portion of them may be torn off and left behind in the uterus. With this object in view, we are advised to twist or rotate the placenta as it is passing the vulva, the membranes being thus twined into a sort of rope which renders them less likely to tear. The uterus is now to be examined, and we must satisfy ourselves of its existence in the form of a firm tumour behind the pubes, about the size of a child's head. The prepared sheet being now pulled from beneath the woman, and with it, as far as possible, the discharges, she may be allowed to lie on the back, with the legs extended and the knees together. In this position, the condition of the uterus may be still more satisfactorily ascertained, and it is a good plan in practice to place the hand of the patient over the fundus, and instruct her to press gently upon it occasionally, which ensures the expulsion of any clots which may be retained, and, in the case of pluriparæ, has an excellent effect in moderating after-pains. So soon as we are satisfied with the contraction of the uterus, and the woman has been made comfortable by the removal of the petticoat, and rolling down of the night dress which has thus been preserved from the discharges, a dry napkin is placed over the pudendum, and the abdominal bandage applied. The object of this bandage, the propriety of which has been disputed, is to afford the uterus and other organs some support, as a substitute for what they have lost in the sudden relaxation of the abdominal walls. If there is any tendency to hæmorrhage, it is usual to fold a towel in the form of a pad, and place it beneath the bandage over the uterus, so as to exercise more direct pressure over that organ. Another and subsequent use of the bandage in the hands of a skilful nurse is the preservation of a woman's figure, a matter to her of no little importance. Bandages are often shaped, in which case they have sometimes a T bandage attached to keep the napkin in contact with the external parts. In ordinary practice, nothing is better than a bolster cover, which, when pinned firmly over the abdomen, serves the purpose admirably.

So soon as the bandage has been applied and the comfort of the mother otherwise attended to, the nurse is at liberty to dress and attend to the child. The patient must be strictly enjoined to maintain the horizontal position, as fatal cases have occurred in women who had imprudently assumed the erect posture shortly after delivery, and had thus established such hæmorrhage as immediately proved fatal. A single glass of sherry or claret with water may be allowed, but it is truly astonishing how seldom this is necessary, so admirably is the effort even of weakly women compensated for. It is advisable for the practitioner not to leave the house too hurriedly, until he feels confident that all is well, and, more especially, that there is no tendency to post-partum hæmorrhage. An excellent physiological method of averting the latter, is to put the child early to the breast, which seldom fails to excite reflex uterine contraction; and this acts otherwise advantageously, although there is no milk in the breasts, by drawing out the nipples.

The Uterus after Delivery.—"Efficient contraction of the Uterus" is an expression which is often misunderstood, and conveys frequently to the young practitioner a quite erroneous impression. Rhythmic contractions do not cease with the birth of the placenta. On the contrary, we may without any difficulty convince ourselves that alternate periods of relaxation and contraction still go on, but one is apt to commit the error of supposing that it is the latter condition alone which is a sign of safety. Far from that being the case, however, the real evidence of safety to the woman is when the periods of contraction and stony hardness cease, and we have a steady and moderate degree of comparative relaxation permanently established. This involves an increase in bulk, and, when we examine the womb eighteen or twenty-four hours after delivery, we shall find, as a normal condition, a larger bulk and softer condition of the womb than what was observed immediately after the completion of delivery.

CHAPTER XVII.

THE MECHANISM OF LABOUR.

Definition of Mechanism of Labour.—Difficulty and Importance of the Subject.—Historical Sketch: Views of Sir Fielding Ould; of Smellie; of Saxtorph; of Solayrés de Renhac; and of Naegele.—Natural and Faulty Presentations.

CRANIAL PRESENTATIONS: *Occipito-Anterior and Occipito Posterior Varieties.*—FIRST POSITION: *Pelvic Obliquity: Occipito-frontal Obliquity, or Flexion: The Head "at the Brim:" Examinations of Fontanelles and Sutures.—Rotation; Causes of.—The "Presentation," or "Presenting Point."—The Caput Succedaneum.—The Chin leaves the Chest.—Further Descent and Birth of the Head.—Obliquity at the Outlet.—Moulding.—External Rotation or Restitution of the Head.*—SECOND POSITION: *the Converse of the First.—Résumé of Mechanism in Occipito-Anterior Positions.*

THE primary idea of Labour comprises three secondary ideas: a body which is to be propelled, a force by means of which the propulsion is to be effected, and a passage through which it takes place. The mechanism of birth thus includes, in its most comprehensive sense, all mechanical questions which spring from the elaboration of these three ideas. The various points connected with the anatomy of the parts, and arising from a consideration of the various forces which contribute to effect the expulsion of the child, having been already fully discussed in preceding chapters, there remains still for careful study, the relation which the body propelled bears to the canal during the different stages of labour. It is in this higher though more restricted sense that the term Mechanism of Labour is employed, and a study of this subject includes, therefore, a thorough and critical examination of the physical laws according to which the process of parturition is effected.

A knowledge of this section of the subject has been fitly described as the keystone of the art of obstetrics. For, without an intelligent apprehension of the various doctrines involved, the practice of midwifery is reduced to a mere handicraft, in which a certain amount of manual dexterity may be attained, but which, under such circumstances, is utterly unworthy of the dignity of a science. We cannot, therefore, too earnestly, nor too emphatically, urge upon the student the necessity of mastering at the outset this important subject, upon which a great part of what is to follow is founded. It is not by any means an easy matter, just at first, clearly to understand the descriptions given in books, or to follow at the bedside the process so described. This demands sustained attention, and a perseverance which is apt to be baffled by the peculiar circumstances under which the investigation is conducted. We may here mention shortly what the chief difficulties are, and how they may in some measure be avoided.

The most effective descriptions, and such as are most useful to the student, are, undoubtedly, those in which unnecessary complication is most scrupulously avoided, and in nothing is simplicity more essential than in the various classifications of labour according to the position of the child within the pelvis. A simple system ought, therefore, in every case to be preferred: in regard to such as are more complicated, it has been well observed that divisions and sub-divisions may be multiplied almost at will. The chief difficulty of the beginner arises from the somewhat complex mental process through which alone he can determine the presentation and position of the child in any given case—a difficulty which the obstetric posture in this country somewhat increases. For not only have we to figure to ourselves the child with its axis inverted—standing, so to speak, upon its head, which is towards the os uteri—but we have also to allow for the posture of the woman, lying, as she does, horizontally, or with the long axis of her body at right angles to that of the accoucheur. Some of this difficulty is avoided by remembering that in most cases the right side of the child corresponds to the right side of the mother; that its back is turned to her anterior or abdominal surface, and that its head is downwards in the direction of the os. These are the first points which it is necessary clearly to understand in regard to the anatomical relations of the child in natural labour; but, essential as such preliminary knowledge is, it has no direct reference to what is known in modern times as the mechanism of labour.

Historical Sketch.—The facts just stated comprise well-nigh all that was formerly known in reference to the child during labour, and their observation led to very erroneous conclusions as to the manner in which its birth takes place. Previous to 1741, it was, as far as we can judge, commonly assumed that there was no special mechanism of labour beyond that which attends any vital expulsive act, and that the passage of a fæcal mass or a half-organized clot was as little regulated by fixed mechanical laws as was the birth of the child. The universal belief was that the child lay in the womb with the face directly backwards, and that, in its descent through the pelvis, it never altered this position in its course from the brim to the outlet, "so that," to use the words of one of the writers of that period, "it seems, when she lies upon her back, to creep into the world on its hands and feet." As in regard to most great discoveries, so in this instance was the development of more correct views a gradual process, and the result of the investigations of successive observers. It was from first to last a process, in the case at least of those who contributed in any considerable degree to its advance, of close inductive reasoning, according to which, step by step, during a period of about eighty years, the subject gradually emerged from obscurity. Nothing tends so much to impress upon the mind the great facts which have been disclosed in the course of this investigation, as a narrative of the successive steps by which the truth was ultimately attained; and we shall, therefore, here call attention to the more important contributions which have, from time to time, been made in this direction.

The honour of the first step in the process of demonstration is undoubtedly due to Sir Fielding Ould of Dublin, who published to the world, about the date above mentioned, a statement to the effect "that the breast of the child does certainly lie in the sacrum of the mother, but the face does not; for it always (when naturally presented) is turned either to one side or the other, so as to have the chin directly on one of the shoulders." The idea here involved is the twisting of the neck, so as to bring the long diameter of the head into parallelism with that of the shoulders, the greatest diameter both of the head and the trunk being thus arranged so as to avoid the limited antero-posterior measurement of the brim. The step next in succession was achieved by Smellie. This excellent obstetrician, whose work is still deservedly ranked among the classics of English midwifery, confirmed Ould's observation that the long diameter of the head occupied the transverse diameter of the brim, as it found, in that direction, the most ample accommodation. But to this, he adds, as the result of his own observations, that the long diameter of the head *rotates at the outlet into the antero-posterior diameter*, which his measurements, allowing for the recession of the coccyx, clearly indicate as the best. In many respects, the views enunciated in this admirable work come much nearer the truth than some of a later date; and its translation into several continental languages brought the opinions of the author prominently under the observation of the medical schools of Europe. From that time, indeed, no writer of note in any language has failed to pay his tribute of admiration to the importance of Smellie's works, and the genius of their author.

The work of Smellie found continental obstetrics in a most unfavourable state as compared with the English school, and provoked much unfavourable criticism. Steadily, however, his ideas gained ground, although considerably disturbed by the excitement of those who joined with Levret in forming what we may term the geometrical school of obstetrics, and who believed with their master "that labour was a purely mechanical operation, and susceptible of geometrical demonstration." The ultimate adoption by the most able continental obstetricians of the views of Smellie undoubtedly preceded the brilliant results which a few years later were disclosed, and for which we owe them so much. It was admitted, as proved by Smellie, that there is a determinate relation between the pelvis and the child's head during the whole time of labour. But the point now for the first time disclosed, was that the head passes into the pelvic cavity, in a position which corresponds neither to the transverse nor the conjugate diameter, *but is intermediate between the two, or oblique.* The names of Saxtorph of Copenhagen, and Solayrés de Renhac of Montpellier, are specially connected with the discovery and announcement of this fact, which was published almost simultaneously by them about 1771. The discovery had, however, been made at an earlier period by Berger, whose pupil Saxtorph had been not later than 1759. Of this, indeed, there is internal evidence in Saxtorph's works, who, far from claiming originality, says in a note to one of his papers on this subject, "In a similar manner, Berger saw the true position of the head in labour, and imparted it in his lectures." But, however this may be, it is certain that, but for Saxtorph and Solayrés, this great truth would have remained unknown, possibly even to the present day. We have elsewhere[1] stated and fully analyzed the views of these distinguished observers, at a length which is here impracticable. We may state, however, in general terms, that the discovery with which their names will always be connected, embraces the fact that the long diameter of the head not only occupies in the pelvis an oblique diameter, but that it occupies most frequently *the right oblique diameter.*[2] Solayrés gives, further, an elaborate account of the mechanism of labour in the different cranial positions, and in this he is followed by his pupil and enthusiastic admirer, the celebrated Baudelocque; the tendency of both writers being to run into too great elaboration in classification and description. Baudelocque seems in some measure to have recognised the rotation which takes place in occipito-posterior positions. Between Baudelocque and Naegele no name occurs, the mention of which is essential to the elucidation of the subject in question.

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[1] The Mechanism of Parturition. London, Churchill, 1864.

[2] The student will carefully note the fact that, in this work, the two oblique diameters take their name "right" or "left" from the sacro-iliac synchondrosis from which they spring. This has already been stated in an early chapter, but is here repeated, as unfortunately, by some writers, the nomenclature of these diameters is reversed. (See p. 32.)

In 1818, Professor Naegele of Heidelberg published, on this subject, a small pamphlet, of insignificant appearance, which was, nevertheless, destined to exercise a greater influence, in regard to this question, on the professional mind than all the ponderous tomes of the hundred years immediately preceding. "No other work of equally small size," as Dr. Tyler Smith well observes, "ever exerted greater influence upon any branch of medicine than that of Naegele upon midwifery. It may be termed, indeed, the Euclid of Obstetrics; but it will not have executed its mission until every accoucheur, in each individual case coming before him, entirely masters the position of the fœtal head. Nothing less than this should be aimed at by every obstetric practitioner." Without in any way attempting to detract from the merit of Naegele—a merit which will have its recognition so long as medical science has a name—we believe that the views promulgated by him have been too implicitly believed in and adopted by the majority of obstetric writers. The translation of his essay by Rigby, and the enthusiastic defence by the latter of every theory and doctrine which emanated from his master, produced a powerful impression; and, in point of fact, for many years, English writers reproduced, without modification, and as demonstrated facts, the whole of the conclusions of the great German obstetrician. Indeed, it is not too much to say that the view generally entertained amounted to this,—that the subject had been so expounded by Naegele that there was nothing further to demonstrate, that every problem was solved, and that his conclusions were to be accepted as an absolute solution of all the difficulties and perplexities of the past.

Many have now ventured, however, both in this country and abroad, to demur to this, and to assert that the matter is not yet set at rest, and that the *ipse dixit*, even of Naegele, is not to be admitted as infallible. And, indeed, if we reflect as to what was the state of the subject when he wrote, while acknowledging that there is that in his discoveries which merits all the fame which attaches to his memory, we can scarcely conceive it possible that one mind could so grasp all the details as to make chaos order, and leave no point unassailable, no question unsolved. In forming his conclusions, no one could be more earnest and faithful in his observations of nature than Naegele, but, in some respects at least, he was mistaken, and from some of his facts he drew erroneous inferences. To him is due the whole credit of showing—although he exaggerates it—that the head not only lies in the right oblique diameter, but lies there in a preponderance of cases such as had never been dreamed of. He demonstrated also, for the first time with clearness and precision, what had before been somewhat obscurely described by Solayrés and Baudelocque—the rotation which naturally occurs in occipito-posterior positions of the head. And he showed that, in ordinary labour, the forehead does not rotate completely into the hollow of the sacrum, but still retains, in a certain degree, its oblique position. Finally, he asserted, and was admitted by most systematic writers to have proved, that there exists, on the part of the head in its descent through the pelvis, a *bi-parietal* obliquity, according to which one ear is approximated to the corresponding shoulder. We accept, in general terms, all his conclusions, with the exception of the last, to the investigation of which we have devoted much time and patience, and conclude unhesitatingly, with Velpeau, Cazeaux, Matthews Duncan, and many others (the number of whom is constantly increasing), that no such bi-parietal obliquity as Naegele described exists as a normal phenomenon of natural labour.[1]

Presentations.—The term "presentation" should, as has already been stated, only be employed to express the relation which the long axis of the child bears to the axis of the uterus; and should never be confounded with "position," which is used in another and more restricted sense. We speak, therefore, of presentation of the head, of the breech, of the shoulder, and so on, as representing the part which occupies the os uteri. The presentations may be multiplied to any extent, as there is scarcely a single point on the surface of the child's body which may not, under certain circumstances, offer itself at the os. In proceeding to the consideration of the various presentations which it is necessary specially to describe, and remembering the attitude of the fœtus within the womb, we recognise the fact that it forms an irregular oval. By either end of this oval, delivery may take place naturally, so that we may consider as Natural Presentations all the varieties known as cranial, facial, breech, knee, and footling cases. When the child lies transversely, the shoulder, or some other part of the superior extremity—or, in other words, the side of the oval—presents; and, as those cases can rarely be terminated by the unaided efforts of nature, they may be termed Faulty Presentations. The following Table, which is given by Dr. Churchill, will give some idea of the relative frequency of the various presentations, as deduced from the practice of different individuals:—

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[1] To examine critically the views of Naegele on this subject would involve the introduction of controversial matter quite unsuitable to a systematic treatise. We feel, however, that Naegele's views have such a hold on British obstetrics, and demand, as well as deserve, such earnest consideration, that we do not consider ourselves justified in passing over with a simple denial any statement to which he has lent the weight of his great authority. We reproduce, therefore, in the form of an Appendix, the reasons which have induced us to reject Naegele's dictum on this point. (See Appendix.)

Author.	Total No. of Cases.	Head Presentations.	Breech Presentations.	Inferior Extremities.	Superior Extremities.
Mad. Boivin, . . .	20,517	19,810	372	238	80
Mad. Lachapelle, .	15,652	14,677	349	255	68
Dr. Joseph Clarke, .	10,387	9,748	61	184	48
Dr. Merriman, . .	2,947	2,735	78	40	19
Dr. Granville, . .	640	619	2	3	1
Edinburgh Hospital,	2,452	2,225	17	8	4
Dr. Maunsel, . . .	839	786	—	21	4
Mr. Gregory, . . .	691	645	14	7	4
Dr. Collins, . . .	16,414	15,912	242	187	40
Dr. Beatty, . . .	1,182	1,105	28	15	4
Mr. Lever, . . .	4,666	4,266	59	29	12
Dr. Churchill, . .	1,640	1,119	35	22	9
Drs. M'Clintock and Hardy, . . .	6,634	5,815	140	61	26
Drs. Sinclair and Johnston, . .	13,748	11,874	309	181	60

Cranial Presentations and Positions.—The enormous preponderance of cranial over all other presentations renders their study by far the most important. We shall, therefore, in the first place, direct our attention to the different varieties of cranial presentations. In respect of the difficulties which the student will encounter, in his endeavour to master this subject, it has already been confessed that these are not inconsiderable. But it is only at the outset that real difficulty will be met with. With every case we observe, and every minute we devote to the subject, what seems almost insurmountable at the first glance will melt away. More and more clearly, as we grapple with the minor difficulties which now arise, do we discern the great truths upon which the science and art of obstetrics depend. Having once fairly mastered the subject, we can never forget it, and so habitual and automatic will our observations become, that we shall find ourselves unconsciously adding to our stock of knowledge, and storing up valuable facts which will stand us in good stead in many an hour of difficulty and danger. But, should the student, at this period of his career, fail to acquire the requisite amount of knowledge which enables him to perfect the *tactus eruditus*, he will most likely never rise beyond mediocrity in obstetrical and scientific knowledge. Success after a fashion he may reach, but his attainments will never much surpass those of an intelligent midwife. Once more, therefore, we would urge upon the beginner, with what emphasis and earnestness we can command, to lose no opportunity of acquiring sound knowledge on so important a subject. Without it, the practice of midwifery is weariness and drudgery; with it, it is a subject of constant interest, worthy of, and affording ample scope for, the highest scientific acumen.

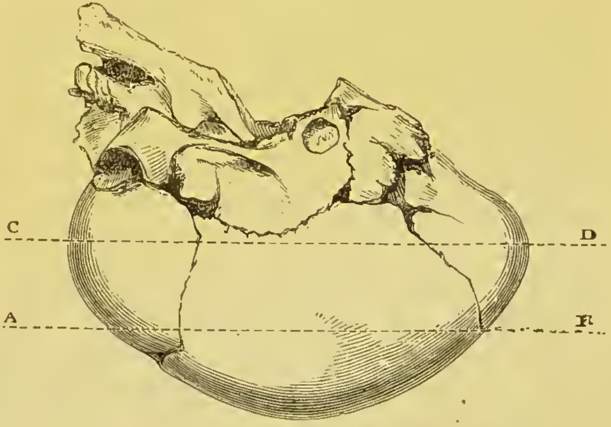
As the occipito-frontal or long diameter of the child's head *may*, in a presentation of that part, lie at the brim of the pelvis in the conjugate, oblique, or transverse diameter, or in any diameter intermediate between these, the number of Cranial Positions may be multiplied to any conceivable extent. Admitting the possibility of all of these, we at the same time recognise the fact, which Solayrés de Renhac has so clearly demonstrated, that the occipito-frontal diameter of the head of a mature child enters a normal pelvis in one or other of its oblique diameters. This admits of but four cranial positions, depending upon the direction in which the poles of that diameter are turned. In two the occiput is turned forwards, and in two it is directed backwards: these are called respectively Occipito-Anterior and Occipito-Posterior. Four positions, therefore, are described, which are termed First, Second, Third, and Fourth:—

OCCIPITO-ANTERIOR,	*First Position,*	Head in Right Oblique Diameter; forehead backwards.
	Second Position,	Head in Left Oblique Diameter; forehead backwards.
OCCIPITO-POSTERIOR,	*Third Position,*	Head in Right Oblique Diameter; forehead forwards.
	Fourth Position,	Head in Left Oblique Diameter; forehead forwards.

First Cranial Position.—The head of the child, which occupies generally, above the brim, a position approaching the transverse, with the face to the right, assumes, as it enters the pelvis, in the great majority of cases, what is called the First Position. The centre of the occiput is turned towards the ilio-pectineal eminence on the left side, while the forehead is directed to the right sacro-iliac synchondrosis. The long diameter of the head thus lies in the right oblique diameter. So soon, however, as the head encounters resistance in its descent towards the cavity, its long diameter ceases to be parallel with the plane of the brim, and nothing can be clearer and more obvious than the advantage which is thus obtained. For this *occipito-frontal obliquity* not only implies the passage of the occiput in advance of the forehead, in a degree proportionate to the amount of resistance, but, involving as it does a flexure of the neck, it thus enables the propulsive force to operate at a greater mechanical advantage, so soon as the chin becomes applied to the sternum. It is, in fact, the *vis a tergo* which causes the obliquity, as is most admirably described by Solayrés in his account of the position which we are now considering. The propulsive forces which impel the fœtus so situated, are communicated, in the first instance, to its vertebral column, the articulation of which with the base of the skull is much nearer the occipital than the frontal pole of the long diameter. This of itself, supposing the resistance to be equal all round, would be sufficient to cause the occiput to take precedence of the forehead; but the movement is further encouraged by the curving of the spinal column, through which the force is transmitted.

"At the Brim."—No term in midwifery is more loosely used than this. We observe that the head, in passing the brim, offers, first, the vertex,[1] then its transverse or bi-parietal measurement, and, lastly, its long or occipito-frontal diameter, so that, although a considerable portion of the cranium has passed the brim, and consequently occupies the cavity, it cannot be said to have cleared the brim until the occipito-frontal diameter has passed. A reference to Fig. 116 will render this more intelligible, the line A B there indicating the bi-parietal plane, and that which is marked C D the occipito-frontal plane, which cannot pass the brim until the former has descended some little way into the cavity. The occipito-frontal obliquity, or flexion of the head, no doubt disturbs in some measure the idea thus expressed, but this, we believe, can only take place when the resistance is considerable, and occurs at an earlier stage than usual. We hold the head, therefore, to be "at the brim," in the proper sense of the term, when the long diameter occupies its plane; but as this can only be approximately ascertained, it cannot be held as a definition which is practically satisfactory. It is better, however, than using the term as

Fig. 116.



Cranial Planes as they engage in the Brim.

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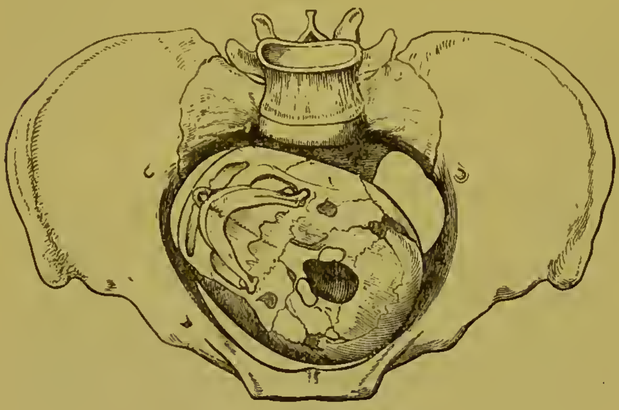
[1] For definition of this term, see p. 148.

many seem to do, without attaching to it any clear meaning whatever. When the uterus is low in the pelvis, the head is often past the brim long before labour begins.

While the head occupies the position indicated in Fig. 117, which we assume to be at the brim—and in which flexion has not as yet occurred—it is scarcely likely that what we have described as the first stage of labour, has, as yet, terminated, or even that the os has reached such a degree of dilatation as to admit of a thorough vaginal examination. In making such an examination at this time, the first point to be remembered is the relation which the finger bears to the uterus and its contents; for most incorrect views will inevitably be adopted if we overlook the fact that the axis of examination forms, with the axis of the uterus and that of the brim, pretty nearly a right angle. The part of the fœtal cranium which is lowest in the pelvis, and which the finger first touches, is the right parietal bone in the neighbourhood of its protuberance.[1] But, if the finger be pushed further back, so as to reach the point on the surface of the fœtal cranium through which the axis of the brim may be presumed to pass, we shall find that this corresponds to some point in the line of the sagittal suture, nearer to one or other fontanelle in proportion to the degree of flexion.

Fig. 117.



First Cranial Position.

Flexion and Obliquity.—The descent of the head is not, in the first part of its course, in a direction which is identical with what has been described as the axis of the pelvic canal. Its movement is, in fact, downwards and backwards in the axis of the brim, until it approaches the floor of the pelvis, and experiences the resistance to its advance arising from the gradual approximation of the ischial planes. Upon the degree of flexion depends entirely the extent to which the occiput is in advance of the forehead. The further dilatation of the os uteri, and the rupture of the membranes, now usually admit of more exact observation by the finger, by which the sagittal suture will be found traversing the pelvis obliquely in the right oblique diameter. In the posture in which the woman is when lying on her left side, we trace this suture downwards and forwards for a short distance, to a point within easy reach of the finger, where it divides into two branches. This indicates the posterior fontanelle, which the pressure generally renders indistinguishable as a fontanelle by approximation and overlapping of the bones. The two branches form the lambdoidal suture. Following the sagittal suture in the contrary direction, and with reference still to the posture of the patient, the finger travels upwards and backwards towards the right sacro-iliac synchondrosis. It requires some effort to reach the anterior fontanelle, not only on account of its being situated posteriorly in the pelvis, but on account of the flexion, which removes it farther from our reach. Very generally, it can only be reached by subjecting the woman to some pain; but it is easily recognised by its size and shape, and by the four sutures which run into it. If the right ear can be reached behind the symphysis without causing unnecessary suffering, the direction of its lobe at once reveals the position of the head.

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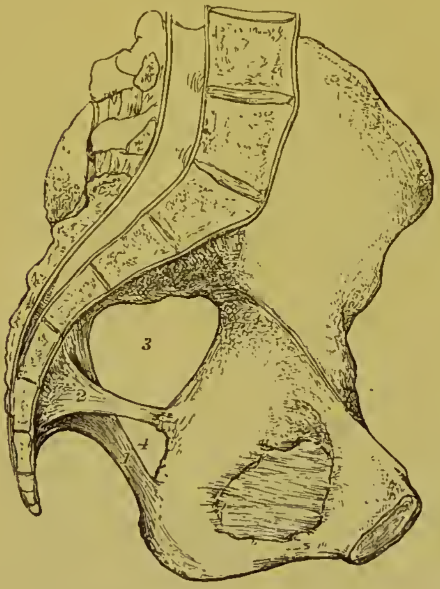
[1] This is one of the points upon which Naegele founded his belief in the existence of bi-parietal obliquity. Our reasons for dissenting from this view are fully given in the Appendix.

Rotation.—In consequence chiefly of the approximation of the sides of the pelvis which has been mentioned, the head now undergoes a change in its position. This is effected by the movement first described by Smellie, which is known as the Rotation of the head. This rotation, which is effected gradually, brings the antero-posterior diameter of the head into, or nearly into, the conjugate of the pelvis, so that the occiput looks forward to the sub-pubic angle, and the forehead backwards to the hollow of the sacrum. The recession of the anterior lip of the os beyond the advancing head admits of an easy examination of this process, which an observer may demonstrate for his own satisfaction by keeping his finger for a time in contact with the head. As he does so, he will often observe, as the head advances and recedes with successive pains, that the degree of rotation is greatest at the height of a pain, while, as the pain passes off, the head resumes its former position. The movement may thus be compared to that of a screw, the action of which is alternately direct and reversed. That nature provides for this rotation of the head in labour is made manifest by an examination of the relative measurements of the brim, cavity, and outlet of the pelvis.

A question which has given occasion for much speculation is the mechanical cause of the rotation. The head, if maintaining its original direction, would simply be arrested at the outlet of the pelvis, its further progress, if of average size, being impossible. In virtue of what law, then, does it so invariably rotate? Some of the older writers professed to recognise in the womb itself a rotatory power (*vis vertens*), by means of which the rotation of Smellie was effected. Others have studied most industriously the mode of action of the various muscles which line the pelvis, believing that in this direction the solution of the problem is to be found; and by one accoucheur of eminence—Flamand of Strasburg—it was supposed that the action of the obturator internus and pyriformis muscles was the cause upon which the phenomenon in question depends. Modern investigation has, however, proved that it is due to the nature of the opposing force which exists at the floor of the pelvis. If we look at the internal lateral surface of the pelvic cavity, as it is here represented, we observe that the tip of the ischial spine is the point which encroaches farthest upon the transverse measurement of the pelvic canal. The head, therefore, as it descends in the right oblique diameter, in the position which we are now studying, arrives at the floor of the pelvis with the occiput in front of the left ischial spine, and, as a consequence, the forehead behind the right spine. Rotation backwards of the occiput or forwards of the forehead is thus effectually prevented. As the propulsive stage advances, the occiput is conducted downwards and forwards by the inclined plane formed by that portion of the ischium which is in front of and inferior to its spine, and by the obturator internus muscle; while on the other side of the pelvis, and on a higher level, the forehead is directed by the yielding sacro-sciatic ligaments towards the hollow of the sacrum. These two surfaces, then, are inclined planes which constitute the female screw, while the male screw is represented by the child's head; and we fully agree with Dr. Tyler Smith, that "the key to the pelvic mechanism, in an obstetric sense, may be said to be the spinous processes of the ischia." Some writers, it may be here observed, describe a posterior inclined plane of the ischium, which is separated from the anterior by an imaginary line leading from the spine of the

Fig. 118.

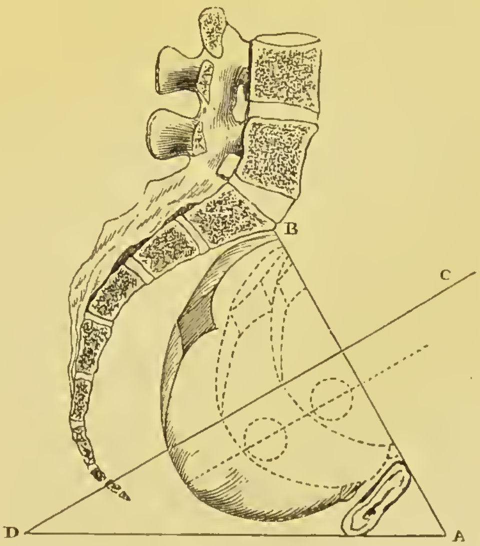


Internal Lateral Surface of Pelvis.

ischium in the direction of the ilio-pectineal eminence. (See Fig. 15, p. 33.) This they suppose to act, in reference to the forehead, as the anterior plane does with the occiput. No such action can, however, be performed by this plane, as the forehead impinges upon the spine and margin of the great notch, and is at once conducted to the ligaments along which it glides. Another obvious effect of this screw movement is to protect the soft structures from undue or dangerous pressure.

We have already used the term "Presentation" in its broader signification. There is, however, another sense, in which it is employed by all British and American obstetricians, which here calls for some special notice, as there unfortunately obtains, in regard to this, as well as other terms in English midwifery, the objection that each writer is left to attach to it his own meaning. The Presentation, in the second and more limited sense, is not the part of the child but the actual "point" on its surface which presents; and, if it be wished to express this correctly, we do not know of a more accurate definition of the term than that given by Professor Hodge of Philadelphia, who described it as "that portion of the fœtal ellipse which is recognised toward the centre of the canal of the pelvis and vagina." This is practically the same as that of Dr. Matthews Duncan—"that point on the surface of the child's head through which the axis of the developed pelvic canal passes." But, while admitting these to be mathematically more correct, we must own to a preference for the meaning which is attached to the word by Dr. Tyler Smith, who defines it as that "portion of the fœtal head felt most prominently within the circle of the os uteri, the vagina, and the ostium vaginæ, in the successive stages of labour."

Fig. 119.



Caput Succedaneum.—When the dilatation of the os uteri proceeds with unusual slowness, owing to rigidity or to premature rupture of the membranes, the Caput Succedaneum forms upon the scalp. This is a swelling, due to pressure, which is to be distinguished from the mere pointing of the occipital pole of the long diameter consequent on the moulding of the parts, and which, involving, as it does, an œdematous condition of the tissues concerned, is essentially a vital process. It is only, however, under the circumstances just detailed, which involve special resistance, that the swelling alluded to becomes developed at this stage, and it will then be found to occupy, altogether or mainly, the right parietal bone.

This is, however, no evidence of bi-parietal obliquity, as the swelling occurs in obedience to the laws of gravity, in the direction of the vagina, where the resistance is least. While the head is undergoing the rotatory process above described, no change whatever takes place in the parallelism which exists between its transverse diameter and the plane of the brim. With reference to the *cavity* of the pelvis, the right side is certainly lower, but this is a very different matter from what is asserted by the followers of Naegele.[1] So soon as a certain amount of rotation has occurred, the vertex descends quite to the floor of the pelvis. The head now becomes exposed to a new set of forces in addition to those which have, up to this time, been the sole cause of its movements. The tissues which form the floor of the pelvis, although they yield, to some extent, before the advance of the head, constitute by their resiliency an opposing force which, while it effectually bars the further advance of the head in that direction, determines a motion which is the resultant of this and the force from above, and being intermediate in its direction between these, is consequently downwards and forwards. Solayrés called this a *reflected* force, and describes the mechanism in the following graphic terms :—" Hujus motûs rationem haud immerito contuleris cum eâ, quæ nucleus prementes digitos fugit." An illustration of this is familiar to every schoolboy who has propelled a cherry-stone fresh from the fruit, by pressing it between his fingers.

As the forehead of the child has, in its course along the back part of the cavity, to traverse a curve which is of much greater extent than the posterior surface of the symphysis, we would anticipate what actually does take place,—viz., that the chin, before the completion of the movement of rotation, leaves the sternum, and that the anterior pole of the occipito-frontal diameter descends, as regards the brim-plane, considerably in advance of the other—this motion being again reversed, at a more advanced stage, as we shall see presently. The successive changes which thus occur in the obliquity of the long diameter are well expressed by Dr. Murphy, when he says that the head may, in the course of labour, be described as "oscillating on its transverse measurement."

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[1] This is roughly indicated in the diagram here given. Fig. 119 shows the great amount of lateral obliquity, in reference to the horizon, of the head advancing in the first position in the axis of the brim, the centre of the sagittal suture being exactly midway between the promontory of the sacrum and the symphysis pubis. It shows also, how, during the whole of this stage of labour, the right parietal protuberance may be described, in general terms, as the part which first meets the finger, or as lowest in the pelvis, advancing, as it does, in the direction of the dotted line, parallel to the axis of the brim. If the head were in the transverse position, the sinking of the parietal protuberance would be still more decided.

A B. The plane of the brim, meeting the horizon at an angle of 60° at *A*.

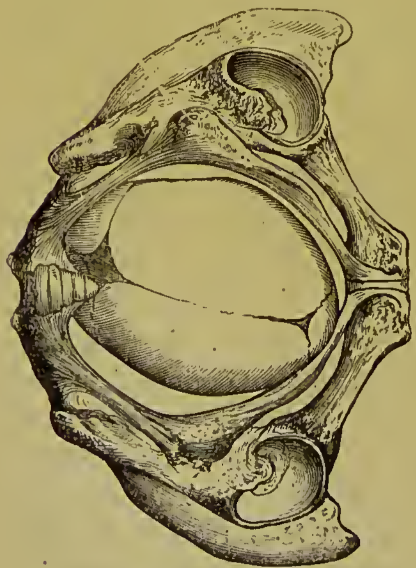
C D. The axis of the brim, passing through the centre of the sagittal suture and the coccyx, and meeting the horizon at *D*, at an angle of 30°.

Birth of the Head.—From the time at which the head comes under the influence of the reflected force of Solayrés, its general direction is altered, and now corresponds pretty closely with the axis of the vagina. The vagina, or what, in its altered anatomical relations, we may more appropriately call the lower portion of the parturient canal, has a curve for its axis, which we have already demonstrated as continuous with the axis of the bony pelvis. (See Fig. 14, p. 31.) The general direction of this is downwards and forwards, so that the head may be assumed now to move in a direction almost at right angles to its original course. The pressure of the head upon the perineum gradually effects the dilatation of the terminal portion of the canal. The left division of the os frontis, in the immediate vicinity of the fontanelle, or the contiguous portion of the parietal bone, presses upon the coccyx, which moves backwards to the extent of an inch, in order to permit of the passage of the child. If the pelvis is at all under the average in point of size, the forehead is arrested at the apex of the sacrum, and the occipital end of the lever is again driven downwards, so as to press upon and distend the perineum. If, however, the parts be ample, and the perineum not unduly resistant, this does not occur, and the whole bulk of the head follows the curve of the sacrum at every pain, obviously attempting to effect an exit immediately under the pubic arch.

Extension.—From the above description, it is apparent that the occipito-mental or longest diameter of the child's head is never at any time thrown across the pelvis. The moment now approaches, however, at which a new movement must be executed, that of extension, and it is difficult at first to see how this can be effected without the extreme diameter being turned into the conjugate of the outlet. Nature fortunately does not attempt this movement until the occiput is passing upwards in front of the symphysis pubis in the act of birth. The motion of Extension is the reverse of the flexion which has been mentioned as one of the earlier mechanical phenomena of labour. The oscillations which the head in its course undergoes on its transverse axis are—first, flexion; then partial extension prior to rotation; then, flexion, if the forehead be arrested at the apex of the sacrum; and finally, the movement of exaggerated extension, which is only completed with the birth of the head. The occipito-mental diameter is not at any moment thrown across, and is only released when its occipital pole is born. The occiput vertex, forehead, face, and chin successively sweep over the distended perineum, the head continuing its curved axis of motion, and being born upwards and forwards in front of the mons veneris.

Before Naegele wrote, it was universally believed that the head was born with its antero-posterior measurement accurately corresponding to the conjugate diameter of the outlet. Some modern obstetricians still hold this view, and it is certain that, in a large number of instances, the head is so born. The Heidelberg professor taught, however, that the head did not pass into the world after this fashion, but that there existed at the outlet a certain amount of pelvic obliquity, as the forehead did not rotate altogether into the hollow of the sacrum; and he showed, in addition, that a certain degree of bi-parietal obliquity is maintained, according to which the right parietal protuberance is, in the first position, born in advance of the left, so that the caput succedaneum is at this stage formed upon the superior and posterior quarter of the right parietal bone, close to the posterior fontanelle. That both of these obliquities generally occur, in what we may call a typical case of normal parts and moderate perineal resistance, we believe; but, in asserting that they are essential phenomena, such as are the movements of Flexion, Rotation, and Extension, the celebrated author committed an error which his followers have but too faithfully copied. For these obliquities are of comparatively trifling importance, and should never have been bracketed with the other and really important movements. Until he has fully mastered the latter, we should advise the student to take no note of these obliquities. The most recent writers on the subject (Küneke, Hodge, and Duncan) all dispute the conclusions of Naegele and argue in favour of the parallelism, or, as they term it, "Synclitism," of the bi-parietal and cervico-bregmatic planes of the child's head, with the planes of the pelvis and the vagina. With reference to the observations of Professor Hodge, it may be remarked that he, his celebrated predecessor Dewees, and, we may add, the American obstetrical school generally, have long repudiated many of the doctrines of Naegele

Fig. 120.

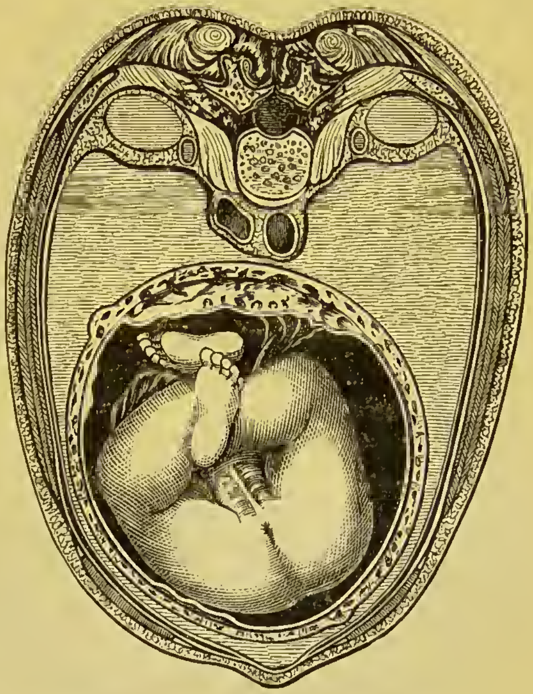


The Head approaching the Outlet.
First Position.

which are still taught in English text books. Fig. 120 shows the relation which the head, when about to pass in this position, bears to the pelvic structures.

Restitution.—No sooner is the head born than (with certain exceptions to be noticed presently) another rotation takes place—the face of the child turning spontaneously to the right thigh of the mother. This is due to the manner in which the shoulders descend. In Fig. 121 we are looking downwards into the cavity of the uterus. It will be observed that the broad or transverse diameter of the shoulders and of the breech occupies the left or opposite oblique diameter to that in which the antero-posterior measurement of the head is descending. Upon the birth of the head, the shoulders encounter the same difficulty from the ischial spines; and, as the rotation must be such as to bring the anterior shoulder, as it did the occiput, under the pubic arch, the left, or posterior shoulder revolves into the hollow of the sacrum. This movement of the shoulders takes place, therefore, in a direction which is the reverse of the previous rotation of the head; so that we may, with perfect propriety, look upon the head as resuming the oblique position which it originally held in reference to the pelvis. It has, on this account, been well called the Movement of Restitution.

Fig. 121.



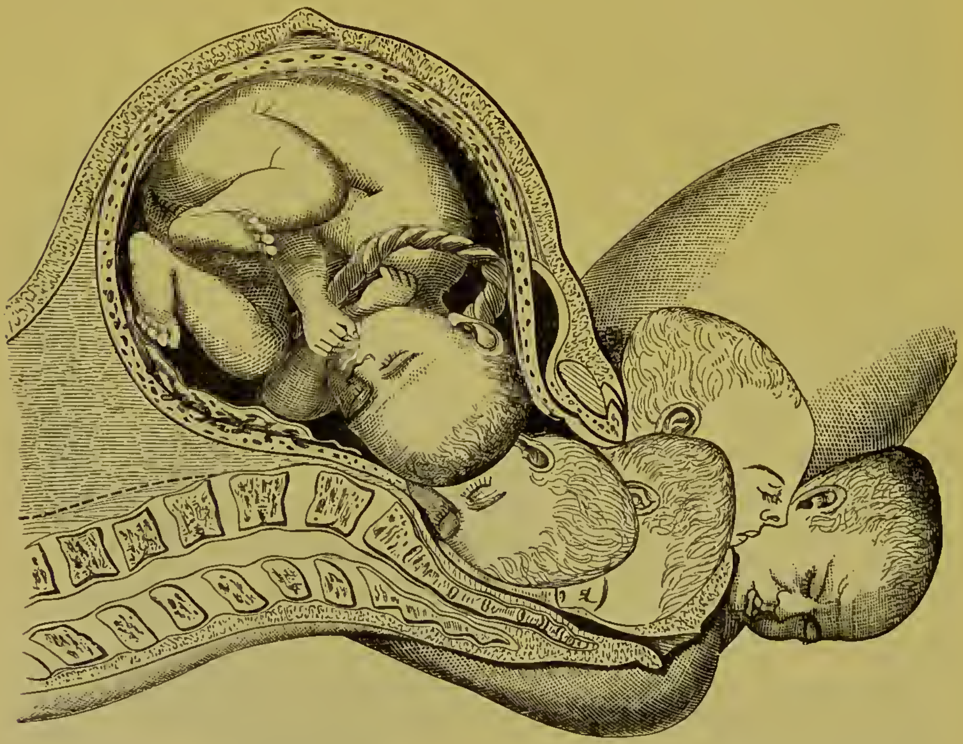
First Position as seen from above. (Schultze.)

Moulding.—There is another phenomenon which should not here be overlooked, inasmuch as it exercises no inconsiderable influence on the progress of labour. This is the moulding of which the head is susceptible, without any risk to the child. The amount of moulding is, of course, proportionate in a great measure to the resistance, but the head, when born, presents, in every instance, a shape which gives it a peculiar elongated appearance, and, in cases where the caput succedaneum is much developed, this is still further exaggerated. The moulding and pointing of the occipital region is the *Hinterhauptspitze* of the Germans;

and the form presented is, as will be shown in the sequel, very different from that which is produced in occipito-posterior positions. As soon as the shoulders have escaped, the mechanical difficulties of delivery may be said to have terminated; for the extent to which the parts have been dilated, during the birth of the head, will have rendered them more than sufficient for the egress of the parts which remain.

We have, in the above description of the first position, gone pretty fully into detail, in order that the other three positions may be more easily understood. We would recommend the student, before attempting any practical investigation of the facts which have been set forth, to follow the description with the bones in his hand—by which means only can he thoroughly understand the subject, to the extent which is essential as a preliminary to the intelligent examination of the phenomena of actual labour.

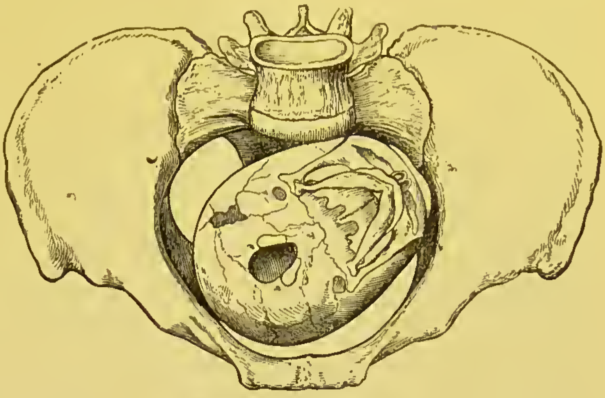
Fig. 122.



Diagrammatic representation of Successive Stages of the First Position.

The figure here shown indicates, diagrammatically, the various positions which the child occupies during the successive stages of labour, as just described. The representation is supposed to be of a woman from whose body the right half has been removed, leaving the fœtus alone untouched.

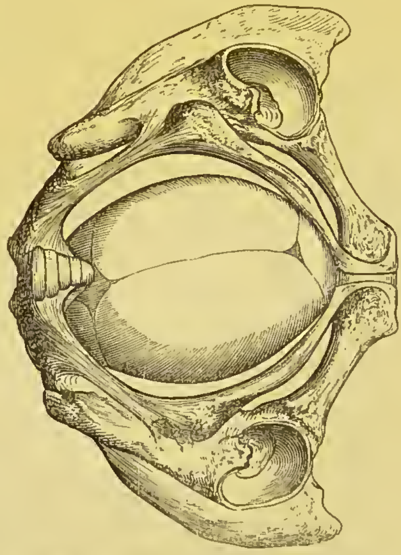
Fig 123.



Second Cranial Position.

Second Cranial Position.—This is in one sense at least, the converse of the First. As the head enters the brim of the pelvis, the occiput is turned towards the right ilio-pectineal eminence, the forehead being directed to the left sacro-iliac synchondrosis. This, therefore, like the first, is an occipito-anterior position, the only difference being that it occupies the left oblique diameter instead of the right. It is the left side of the head which presents, and the neighbourhood of the left parietal protuberance is, therefore, the part which the finger first reaches in a digital examination. The sagittal suture corresponds to the left oblique diameter, so that, when the woman is on her left side, the finger passes upwards and forwards to reach the posterior fontanelle, and downwards and backwards to reach the anterior. The occipital pole of the antero-posterior diameter of the child's head is, as in the first position, driven downwards in advance of the other. It glides, during the rotation which succeeds, in a direction downwards and forwards, along the ischial plane on the right side, towards the sub-pubic arch, while the forehead moves from left to right, along the left sacro-sciatic ligaments, towards the hollow of the sacrum. The head, after complete rotation and sufficient distension of the perineum, approaches the orifice of the parturient canal, in a position which generally approaches that shown in the annexed figure (Fig. 124), in which a certain amount of left obliquity still exists, and the left parietal protuberance is a little in advance. The face, upon its birth, turns towards the left thigh of the mother, while the shoulders after

Fig. 124.



Second Cranial Position at the Outlet.

passing the brim in the right oblique diameter, are rotating so as to bring the left shoulder under the pubic arch.

With reference to this external rotation of the head, it must here be remarked—and the observation applies equally to first and second positions—that the rotation described in each case, while the rule, is a rule which admits of exceptions. It is no doubt true that an observation of the external rotation of the head may generally be received as evidence—confirmatory, or the reverse—of the diagnosis which we may previously have formed as to its position in the pelvis. But this is by no means invariable, as sometimes, in undoubted first positions, the face rotates to the left, and in second, to the right; the direction of the movement in each of these cases being a continuation, by the shoulders, of the same screw motion previously performed within the pelvis by the head. Occasionally, as Naegele admits, and probably in cases where the diameters are greater than usual, the shoulders pass in the transverse diameter, and there is no rotation at all; while in cases rarer still, as is described by Schmitt, "the face of the born head turns itself, first to the one side and then to the other, as if to ask of nature in what direction the descent of the shoulders could best take place."

Recapitulation.—Once more let us recapitulate the various movements which the head undergoes in the two Occipito-Anterior positions above described, and note very briefly their mode of action as mechanical aids to labour:—

The general direction followed by the head of the child from the brim to the floor of the pelvis is that of the axis of the brim. The longer diameter of the oval formed by the head occupies one or other oblique diameter, as it finds in these the longest measurement.

By the Antero-Posterior Obliquity of the head, not only is the occipito-mental diameter prevented from lying, by any possibility, across the pelvis, but the occipital pole of the occipito-frontal is so depressed that a further and obvious mechanical advantage is gained. This is otherwise called Flexion of the head.

Rotation is a movement of the head upon its perpendicular axis, according to which its longer diameters are moved into, or nearly into the conjugate of the pelvis, which is at this stage the most ample. This is mainly effected by the anterior ischial planes, and the yielding of the sacro-sciatic ligaments.

The movement of Extension is that which occurs at the moment of birth, its most important object being to admit of the passage of the great occipito-mental diameter without injury to the perineum. It is, like flexion, a movement of the head on its transverse diameter. The chin leaves the sternum of the child as it descends through the pelvis, a certain amount of flexion again occurring if there is much resistance at the apex of the sacrum, but it is only when its head is passing the external parts that the exaggerated movement occurs to which the name Extension has *par excellence* been given. The general direction of the movement, from the time the head reaches the floor of the pelvis, is downwards and forwards, but the head follows the parabolic curve of the axis of the passage.

The Pelvic Obliquity of the head at the outlet is probably due to the position of the shoulders; the bi-parietal obliquity is accounted for by the head still retaining something of its original parallelism to the plane of the brim. Neither is of much importance, but the latter, by permitting one parietal protuberance to precede the other, diminishes, to a slight degree, the circumferential measurement of the ostium vaginæ at the moment of its greatest distension.

The External Rotation of the head is caused by the rotation of the shoulders in the opposite oblique diameter to that which was occupied by the head. As the result of this is to restore the head, by a movement on its perpendicular axis, to its original position, it has been called the movement of Restitution.

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CHAPTER XVIII.

THE MECHANISM OF LABOUR—(CONTINUED).

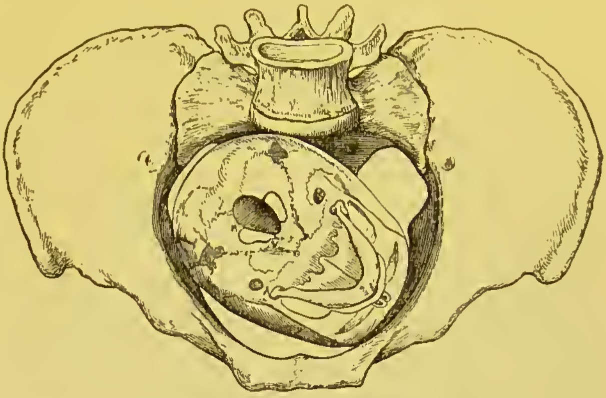
Occipito-Posterior Positions.—THIRD POSITION; *rotates into the Second, or may terminate with Forehead forwards.* FOURTH POSITION; *rotates into the First, or may terminate with Forehead forwards.—Artificial Rectification of these Positions.—Comparative Frequency of the Four Cranial Positions.*

FACE PRESENTATIONS.—*Distinction between "Obstetrical" and "Anatomical" Face.—Mento-Posterior and Mento-Anterior Varieties.*—FOURTH POSITION: *Mechanism of.*—THIRD POSITION.—FIRST POSITION; *rotates into the Fourth.*—SECOND POSITION; *rotates into the Third.—Relative Frequency of Facial Positions.—Operative interference in.—Irregular Presentations.—Tabular Comparison of Cranial and Facial Positions.*

IN the two remaining or Occipito-Posterior positions, the head lies, as in the Occipito-Anterior, in one or other of the oblique diameters, so soon as it fully occupies the brim. The reversal, however, of the frontal and occipital poles of the long diameter of the head here renders necessary the application of mechanical principles, which in some respects differ very widely from those which have been explained as accounting for the phenomena attendant upon delivery in the occipito-anterior positions. This becomes to some extent obvious upon an examination of the cranium itself, and by a comparison of the broad unyielding forehead with the pointed compressible occiput. But, if we observe further the relation which the pelvic cavity bears to possible movements of flexion and rotation, it will at once become apparent that in these positions nature has difficulties to overcome in comparison with which those attending the occipito-anterior positions are probably trifling. What these special difficulties are, we shall attempt to show, noting carefully, at the same time, the means which nature adopts to overcome the impediments which thus arise.

Third Cranial Position.—The head in this case enters the brim of the pelvis in the right oblique diameter, with the forehead turned towards the left ilio-pectineal eminence and the occiput to the right sacro-iliac synchondrosis, as shown in the accompanying figure. On a digital examination, it is the left parietal bone which the finger touches, in the neighbourhood of its protuberance, at a point usually a little anterior to that reached in the second occipito-anterior position. With reference to the posture of the woman, the sagittal suture is traced downwards and forwards, where it ends in the large lozenge-shaped anterior fontanelle; while, in the contrary direction, it may be followed upwards and backwards, terminating in the posterior fontanelle. This point is here of paramount importance in the diagnosis, for when, in any case, we find that the great fontanelle is within easy reach of the examining finger, our suspicions should at once be excited, and the nature of the position carefully ascertained.

Fig. 125.



Third Cranial Position.

So soon as the head becomes engaged in the brim, one of two things may occur. In the one case, the occiput is driven, by the propulsive force communicated through the spinal column, downwards in advance of the forehead, as in occipito-anterior cases; in the other, the occiput is arrested, and the force being thus transferred to the frontal pole of the long diameter of the head, that pole precedes the other in its descent. Whether the forehead or the occiput thus descends, there is, in the great majority of cases, no barrier to the termination of the labour by the unaided efforts of nature, although such cases are more or less protracted. When the head, therefore, is placed in the third position, the labour may terminate in two ways, either by rotation into the second position or by the forehead passing under the pubis. As the former is the rule, and the latter a rare exception, we shall first consider the mechanism according to which, in the great majority of cases, such labours terminate.

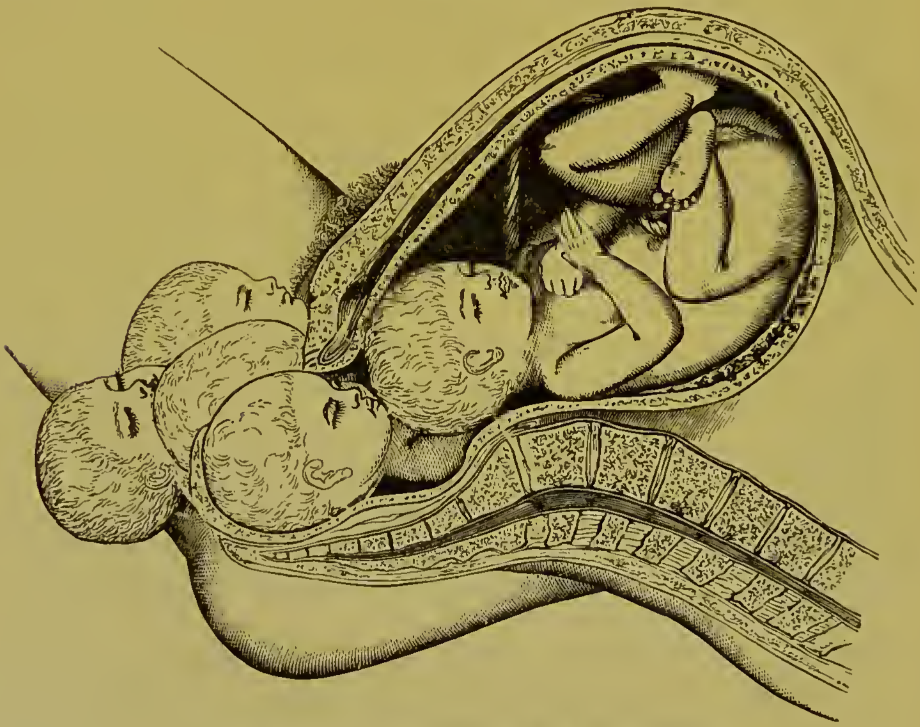
Usual Termination.—The natural termination of the third position is by a movement which in extent far exceeds the ordinary rotation of the head. The facility with which this occurs depends in no small measure upon the capacity of the pelvis. For nothing is more essential, as a preliminary to this movement, than an easy descent of the occiput in the direction of the right sacro-sciatic ligaments; whereas, any difficulty which may exist, from peculiar formation or contraction of any of the diameters, by arresting this initiatory movement, favours the descent of the forehead. The more marked the flexion of the head, therefore, and the nearer the posterior fontanelle to the examining finger, the greater is the confidence with which we anticipate a natural and satisfactory rotation. If, as is frequently the case, the head descends quite to the floor of the pelvis before rotation has occurred, depression of the occiput and corresponding recession of the forehead are still the signs which point towards rotation. For, in this situation, the forehead, which occupies the inclined plane of the ischium on the left side, cannot, on account of the approximation of the ischial spines, rotate directly in the same pelvic plane. It is essential, therefore, that the forehead should be elevated above the spine of the ischium, and the antero-posterior diameter of the head thus shortened in reference to the pelvic planes. This is precisely what is effected by flexion at this stage; and, if we watch the process with the finger, we observe, in the first instance, that the anterior fontanelle recedes from our finger in the direction of the horizontal ramus of the pubis. The posterior fontanelle descends and comes within easy reach, until the flexion is so complete that the occipito-mental diameter approaches the axis of the brim. A rotatory or screw motion of the head now becomes manifest, the forehead moving upwards and backwards on the left, and the occiput downwards and forwards on the right side of the pelvis during a pain; while the head resumes its former position during the interval. Presently, and often in the course of a single pain, it performs a rotation equal in extent to the quadrant of a circle; and, if we now make an examination, we find that the head occupies what was described in the last chapter as the second cranial position. In its normal and natural course, therefore, *the third position rotates into the second.*

The rotation thus effected is remarkable not only in regard to the extent, but also in respect of the mechanism by which it is effected. If the mechanism were identical with what obtains in the occipito-anterior varieties, the forehead would, in every case, be directed by the ischial spine over the left ischio-pubic ramus towards the sub-pubic arch. But the mechanical result of pressure transmitted through the vertebral column is the same in all cases where the pelvic resistance is equal on all sides. The occiput being thus pressed down, the forehead rises as has been described, and the chin is approximated to the sternum. A point is presently reached at which the whole forehead has risen above the level of the ischial spine, and the rotatory movement commences. The occiput, on the other side, is beneath the right spine, and approaches the centre of the pelvis, being directed downwards and forwards, on the right side, by the corresponding margin of the sacrum and coccyx, and the sacro-sciatic ligaments. This is probably the cause of the first effort at rotation, but as soon as the forehead passes sufficiently far back to impinge upon the posterior ischial plane, it at once glides along this to the left sacro-iliac synchondrosis, and the rotation is complete. Afterwards, (the presenting point being as before a portion of the left parietal bone,) the case goes on as if it had been from the first a second position, the only difference as effecting the progress of the labour being that that process has now to commence—should it be required—which consists in moulding of the hindhead, and which, under other circumstances, would already have been effected. From what has been said, it will be understood that the earlier and the more easy the descent of the occiput, the more uninterrupted and satisfactory is the course of the labour: in such cases there is in fact no special difficulty, and no additional danger to either mother or child. But, in cases in which the forehead continues to descend, the difficulty of rotation is greatly enhanced, for in that case the preliminary flexion involves the necessity of the occipito-frontal diameter being thrown across the pelvis; and, if the measurements generally are small, this can only be effected with considerable difficulty, a difficulty which is increased by a certain degree of moulding, and the formation of the caput succedaneum in an unusual situation. But even these cases will usually terminate as second positions, more especially if a certain amount of assistance be afforded in a manner to be hereafter described.

Fronto-Anterior Termination.—In a small proportion of cases, but certainly much more frequently than Naegele and his followers would have us suppose, the rotation above described does not take place. The forehead, in these instances, sinks lower and lower in the pelvis, and the anterior fontanelle approaches still more closely to the ostium vaginæ. A very useful practical distinction was drawn by the late Dr. Uvedale West of Alford, a veteran practitioner who devoted much earnest thought to the subject now in question. Dr. West, recognising the flexion of the head as an essential element in rotation, proposed that those cases in which the frontal pole of the long diameter remains high, all of which end by rotation, should be called *bregmato-cotyloid*, while the others which terminate, or threaten to terminate, with the forehead forwards, should be designated *fronto-cotyloid*—a simple distinction of unmistakable importance.

When the head assumes this fronto-cotyloid position in a well-marked degree, we may be pretty sure that it will end with the forehead forwards instead of the occiput. But we must not too hastily adopt this conclusion, as cases have been observed in which, at the last moment, when the part presenting had already shown itself at the external aperture, the forehead spontaneously moved up, and delivery was effected, after rotation, in the usual way. The attention of the accoucheur, should he have omitted to notice it previously, may be attracted by the fact that the labour is progressing in an unsatisfactory manner, and that the progress made is quite out of proportion to the expulsive force; and, on examination, he now recognises the nature of the case with which he has to deal. At this time, the orbits and nose may be easily felt behind the pubes, and as labour progresses the forehead comes into view. Cazeaux says that the superciliary arch may sometimes be seen, and that on one occasion he saw the upper eyelid. Under the influence of powerful uterine contraction, the occiput is now driven downwards, the head executing thus tardily its movement of flexion. The perineum becomes distended to a dangerous extent by the posterior part of the head. This cannot be relieved, as in the ordinary position, by the movement forward of the occiput, to which the forehead offers no resemblance in shape. The presenting part

Fig. 126.



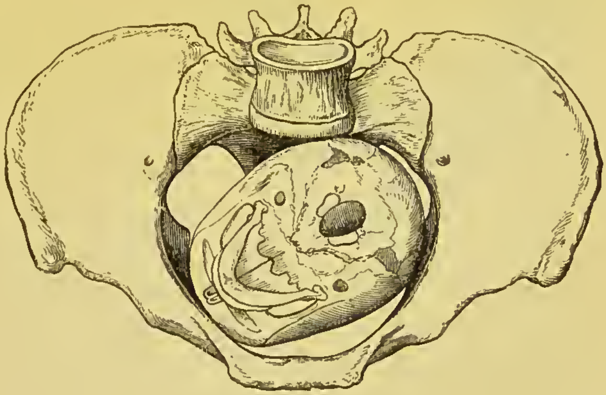
Fronto-Anterior Termination of the Third Position.

moves, therefore, somewhat upwards and to the left, until the occiput passes over the strongly distended perineum. The final movement is performed by an extension of the head—the nape of the neck, pressed against the anterior margin of the perineum, being the centre upon which the revolution occurs which brings the forehead, nose, mouth, and chin, successively from beneath the pubic arch. The motion at this point is precisely analogous to what obtains in first and second positions, where the centre of the motion is the sub-pubic angle, and the forehead and face sweep forward over the perineum. There is certainly in all such cases an increased risk of perineal laceration. The various stages in the mechanism of delivery in this position are shown in the accompanying diagram. (Fig. 126.)

Another possible termination of occipito-posterior positions consists in a continued movement of extension, or rotation of the head on its transverse axis, by which the case is changed into a presentation of the face. And, moreover, since such a rotation as this would bring the chin forwards—which is, as we shall show, in a face presentation, a quite favourable position—we may assume that such an occurrence would be rather a favourable termination than otherwise to the cases which Dr. West described as *fronto-cotyloid.*

Fourth Cranial Position.—The head, in this position, enters the brim of the pelvis in the left oblique diameter. The forehead is turned towards the right ilio-pectineal eminence, and the occiput to the left sacro-iliac synchondrosis, as shown in Fig. 127. On a digital examination, it is the right side of the head which the finger touches. The sagittal suture, in reference to the posture of the woman, is traced downwards and backwards to where it terminates in the posterior fontanelle, while, in the contrary direction, the finger follows it upwards and forwards to the anterior fontanelle. The opinion is very generally entertained that, in the fourth position, the engagement of the head is more difficult, and its rotation slower than in the third. It is impossible to avoid the conclusion that this is due, in a great measure, if not entirely, to the

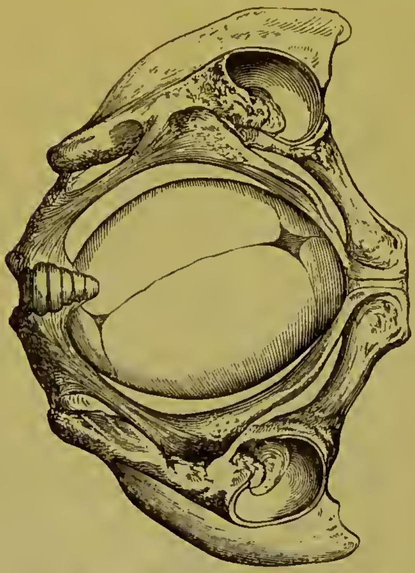
Fig. 127.



Fourth Cranial Position.

rectum, which, by encroaching upon the left oblique diameter, renders it less capacious than the right. The fourth position being the converse of the third as the second is of the first, we find the description of the one will serve, *mutatis mutandis*—reading right for left, and so forth—in every respect for the other. It may thus terminate in two ways, according as the occiput or the forehead descends. In the former case, the occiput passes below the left, and the forehead above the right ischial spine, so that *the fourth position rotates into the first* in the natural and normal course of such a case, and ends with the occiput under the pubic arch as usual, the right side of the head thus being, during the whole course of the labour, the lowest in the pelvis. In this, as in the third position, a certain number of cases terminate with the forehead under the pubes, the mechanism, in each case, being precisely similar, the occiput usually passing over the fourchette, whereupon the forehead, nose, and chin sweep successively backwards and downwards, from behind the pubic symphysis. The position of the fœtal head in reference to the outlet of the pelvis is shown in the engraving. If we admit the possibility of conversion of a third position into a face case by rotation on the transverse axis of the head, we must also admit it in the case of the fourth position. And it is worth noticing that such a rotation would directly, and without further change, convert the position which we are now speaking of into that position of the face which is most frequent in its occurrence. In all cases in which the forehead is born forwards, the ordinary process of moulding is reversed, and the head presents a very remarkable appearance, owing to the flattening of the occipital, and bulging of the frontal regions.

Fig. 128.



Fourth Cranial Position at the Outlet.

The comparative difficulty which arises from the situation of the rectum constitutes, therefore, as it would seem, the only practical distinction between third and fourth positions. All observers seem to have agreed in this—that, in the fourth, the rotation takes place as a rule, and probably on account of this very difficulty, on a higher level as regards the pelvis; and that, if it descends to the floor of the pelvis with the forehead still directed towards the right obturator foramen, the chances of rotation at this more advanced stage are less than in the third. Rotation, at an early stage of labour, before it is yet practicable to ascertain the actual position of the head with anything like certainty, is probably of much more frequent occurrence than we have any idea of. Few things are more familiar to the experienced accoucheur than a rotatory or rolling movement of the head, which he observes either during a pain or an interval, while it is still high in the pelvis. This is due partly to uterine action, and partly to the movements of the fœtus, and we have no doubt that, by this means many unnatural and faulty positions are rectified even after labour has commenced; and we are further entitled to assume that in this way many occipito-posterior positions are rectified at such a stage that their detection is rendered impossible. It should always be remembered that the dorso- or occipito-anterior position of the child is the natural one, and that according to which the irregular oval which it forms is most conveniently disposed.

Artificial Rectification.—Recognising, as we now do, the natural termination of third and fourth cases as second and first respectively, a very important practical point arises, which may perhaps be most conveniently discussed at this place. This is the possibility of rectification by artificial means of occipito-posterior positions, which are about to terminate, or threaten to terminate, with the forehead towards the pubis. No possible doubt can exist as to the fact that the position of the head may be, and often has been, changed by the operations of the accoucheur. In confirmation of this assertion, we have the evidence of the most eminent obstetricians. More than a century ago, Smellie, after having repeatedly but in vain attempted to drag the head through in a case of this kind, bethought him of trying to turn the face backwards into the hollow of the sacrum. Success attended his first attempt—a result which "gave him great joy," and opened his eyes to a new field of improvement "in the method of using the forceps in this position." Clarke, Burns, and others, stated that rectification could be brought about in many cases by the use of the finger alone; and, among accoucheurs of our own day, Murphy and Uvedale West have emphatically expressed their views in favour of the feasibility of this proceeding.

As regards the period of labour at which rectification may be effected, we find that many writers assert, or at least imply, that the operation may be performed at any stage. The fact is, however, that the head cannot in ordinary circumstances be rotated until it has reached that stage of the labour where nature as a rule spontaneously induces the rotation, so that it will often be a matter of difficulty to say what share in the movement we are to award to nature and what we may claim as the result of our operative interference. The conclusion with reference to the subject at which we have arrived is that we may succeed in amending the position of the head in two classes of cases. In the first of these, the head is free at the brim, or at least has not as yet encountered any serious pelvic resistance; and here rotation may be effected by the forceps in a manner which will be more particularly alluded to when we come to speak of the uses of that instrument. In the second class of cases referred to, the head has reached the floor of the pelvis, where we have natural rotatory forces operating in our aid; but no attempt, while the head is in a situation intermediate between these two, is likely to be attended with success.

The forceps is quite inapplicable, for the purpose of rotation, to the class of cases last mentioned, for reasons which are obvious. The surest and safest guidance is to be found in a careful study of the mechanism by which nature at this stage effects the rotation. And, if we do so, it will soon become apparent that it is only by imitating or assisting nature that we can hope for success. If we attempt simple rotation, the ischial spines interpose a barrier which it is almost impossible to surmount; but if, on the other hand, we take nature for our guide, and assist her in the direction which she indicates, we must employ our whole efforts in promoting the preliminary flexion of the head, which has been fully explained in the description of the third position. With this in view, then, we should press the forehead upwards, in the direction of the ilio-pectineal eminence, on the side in which it lies. This is done most effectively by bringing two fingers to bear upon it and pressing in the direction indicated during a pain. This, in the first instance, will probably have little effect in displacing the forehead, but if we can only succeed in preventing its further descent, we thus transfer in some measure the propulsive force to the occiput, and in a greater or less degree encourage the essential movement of flexion. After a time, the effect of this will probably become manifest in a recession of the frontal pole of the long diameter. But, should the effort fail, we may, as Dr. West suggests, attempt to pull down the occiput by means of the instrument called the vectis, while continuing the pressure with the fingers as before. By one or other method, or by a combination of both, we may often succeed in effecting the natural flexion of the head, until the forehead is high enough to pass above one ischial spine and the occiput low enough to pass beneath the other, when nature herself will effect the actual rotation, and may be left to complete the labour without any further interference. Madame Boivin seems to have entertained the belief that, in the third position, something may be gained by emptying the rectum so as to facilitate rotation into the second; and that, as regards the fourth, a distended rectum is rather an advantage than otherwise, inasmuch as it would tend to prevent the movement of the occiput into the hollow of the sacrum, and so indirectly encourage the rotation into the first position, which we desire to promote.

While the four positions which have now been described are all which we think it necessary to specify in detail, there can be little doubt that, under exceptional circumstances, others may be met with. The accidental position, for example, of the head in the conjugate or transverse diameters of the brim has, in the opinion of many approved authorities, warranted them in adding four more, making eight positions in all. We apprehend, however, that the mechanism, in such rare instances as may be met with of conjugate or transverse as primary positions, does not call for any special description, and that to admit them would be unnecessarily to complicate a subject already beset with sufficient difficulties. Both of the positions indicated would, in a normal pelvis, inevitably be resolved into one or other of those which have been described, and would thus terminate according to the laws which we have attempted to elucidate; while, if they were the result of abnormal disproportion of the parts, they would come under the influence of special laws, which it is no part of our object at present to explain. We take no notice, it will be observed, of premature birth or putridity of the fœtus, in which the child *may* pass in any diameter; but even here the tendency is to follow the natural course.

Comparative Frequency of the Positions.—We have now to consider the subject of the comparative frequency of the cranial positions. It may be considered that this ought to have been referred to at a somewhat earlier stage. We have, however, purposely postponed it until now, as considerations arise, in reference to points not yet fully determined, which can only be understood by those who are in possession of the facts which have been detailed in this and the preceding chapter. It is to be regretted that no inconsiderable differences of opinion, on many of the points referred to, have arisen in consequence of the views of Naegele having been implicitly received, while yet they obviously lacked confirmation.

From the time of Smellie, the first position has been universally admitted as that which is by far the most frequent. Until the publication of Naegele's celebrated essay, there was a similar unanimity among obstetricians as to the second position being next in point of frequency to, and in all respects the converse of, the first; but the effect of his researches upon the minds of all modern practitioners has been to modify greatly, and in most cases entirely to overthrow, the conclusions of his predecessors on this point. In order to avoid a mass of statistical details, we shall only attempt here to compare the conclusions of Naegele, and of those who agree with him, with the results attained by some modern observers who differ from him more or less widely. The following table shows the percentage of each of the four cranial positions, as deduced from the published statistics of the observers quoted :—

	First Position.	Second Position.	Third Position.	Fourth Position.	Not Classified.
Naegele, ...	70·	—	29·	—	1·
Naegele, the younger,	64·64	—	32·88	—	2·47
Simpson and Barry, .	76·45	·29	22·68	·58	—
Dubois, ...	70·83	2·87	25·66	·62	—
Murphy, ...	63·23	16·18	16·18	4·42	—
Swayne, ...	86·36	9·79	1·04	2·8	—

By means of this tabular arrangement, we see at a glance the extent to which, apparently, one observer differs from another, but we must look a little closer at the figures to discover their true import. In the first place, we may observe that the two Naegeles regarded the second and fourth positions as so exceptional that they did not include them at all in their system of classification, contenting themselves with the assertion that, when present, there were either some special circumstances which induced the irregularity, or that the observations were not made sufficiently early in the labour. The elder Naegele, indeed, says that, to positions of the third kind, those of the face come next in point of frequency, while the second is classed by him with the conjugate variety, as rarest of all. The younger Naegele, again, who, while he enters into statistical details much more deeply, repeats and corroborates his father's doctrines, lays himself open in more than one place to criticism, in respect of the manner in which he disposes of his statistics to suit his own views. He states, for example, that his conclusions are based on 3,795 cases of cranial presentation, but instead of placing these fairly under the four heads which constituted essentially the classification of the German school, he boldly says : "After deducting 94 cases, in which the original position of the head could not be made out on account of various circumstances, we have 3,701 carefully observed cases of cranial presentation." Now, these 94 cases form nearly two and a half per cent. of the whole, and if divided, as we cannot doubt they ought to have been, between the positions numbered second and fourth, would have brought the statistics of Naegele very near to those of Dubois, whose observations accord perhaps as closely as those of any other with the prevailing ideas of the present day.

The statistics of Simpson and Barry confirm the conclusions of Naegele more closely than any others; but, it will be observed that a certain percentage of second and fourth presentations is admitted, which becomes more marked in the figures of Dubois.

The conclusions arrived at by the two observers whose names are placed last upon the list, indicate a startling discrepancy with the results given above, and are of themselves sufficient to show that the doctrines of Naegele are by no means definitely settled. Dr. Murphy's conclusions are the result of a careful personal observation, in the Dublin Lying-in Hospital, of sixty-eight cases of cranial presentation, in which he found the second position to occur as frequently as the third. His conclusions may at first seem to be less satisfactory than if they had been based upon a larger number of observations; but, at the same time, we must admit that the results obtained by so able and experienced an accoucheur as Dr. Murphy, should be held as more likely to be correct than when the observations on which statistics are founded are entrusted in a great measure to others. The experience of Dr. Swayne shows a larger number of cases of first position than any other observer, and in other respects his deductions are still more strikingly opposed to the idea generally received. Reverting to the opinion held before Naegele, he believes that in point of frequency the second comes after the first, and that the fourth is more frequent than the third, an opinion in which he is supported by Professor Millar of Louisville. In the table above given we have avoided extremes, or we could have given statistics which have been offered in proof of assertions which are, as regards the views of Naegele, more contradictory still.

In attempting to reconcile statements so conflicting, we cannot fail to become convinced of the fact that, even in the most experienced hands, it is no easy matter to determine the position of the head in the early stage of labour. It is not to be conceived that all the observers above quoted can be right. It is equally clear that nature must have some law, according to which the head of the child enters and passes through the pelvis of the mother. But is it in our power to determine what is the law of nature, and in what this or that observer has erred? Can we so reduce the law to statistical results, as to place the matter for ever on the basis of irrefragable evidence? He would be a bold man who, in the present state of the art, would venture to answer these queries in the affirmative. For our part, we are convinced that there is ample room for renewed observation and research; but, unless a man can bring to bear upon the subject a mind unwarped by prejudice or preconceived ideas, his testimony will be of little avail. Take, by way of example of this, the second position. Who has not been summoned, again and again, to the bedside of a woman in labour, to find the head in the lower third of the pelvis, and in the position in question? In such a case, the disciple of Naegele would probably record in his note-book, "A case of third position, in which rotation had occurred before my arrival." He is driven to this conclusion, if he adopts Naegele's theory, but yet, as regards the individual case, the evidence is Naegele's and not his. Or, again, if quite early in labour he finds the head undoubtedly in the second position, he classifies it as irregular, and assumes the presence of some of the "various circumstances" in which only, says Naegele, this position can occur. To be candid, however, we must admit of the possibility of a mistake which is the converse of this, and which would be committed by him who should rank every case as second, without any reference to the stage at which the first examination is made. It must, we think, be manifest, that correct conclusions on this subject can only be based upon a large number of observations, in which the position of the head is ascertained, in every case, at the beginning of the labour, or before it experiences any pelvic resistance further than that which is due to gravity.

Granting that the first position is by far the most frequent, occurring, as it does, in nearly 70 per cent. of all cranial presentations, and, granting further, as we do, that Naegele's discovery—that the third is, as a primary position, next to the first in point of frequency—is correct, we are persuaded that both second and fourth cases occur more frequently than is generally supposed—certainly much more frequently than Naegele would have us believe. We are inclined to think that, by striking an average between the percentage yielded by the statistics of Dubois and Murphy respectively, we should come very near the truth. The proportion thus deduced stands nearly as follows:—

First Position.	Second Position.	Third Position.	Fourth Position.
67	10	20	3

The second cranial position is then, as we have shown, in most respects, both as regards pelvis and cranium, the converse of the first, and it is difficult to account for its comparative infrequency on any other ground than the presence of the rectum on the left side. It is somewhat strange that Naegele should reject this theory as improbable, as it is very obviously in favour of his argument that all cases, almost without exception, lie originally in the right oblique diameter; but perhaps we should, instead of being surprised at this, take it as evidence of his impartiality. Whether the rectum may, or may not, have an influence in determining the original position, it is clear that it bears practically on the progress of labour, especially if distended. But, even should it be empty, it is conceivable that the thickness of the coats of the bowel may tend to make a tight fit tighter.

The proportion of occipito-posterior positions which end with the face to the pubes is, for obvious reasons, very difficult to determine. It is not to be wondered at, perhaps, that great difference of opinion exists as to the proportion of cases which perform the usual rotation backwards; but it is a little astonishing that the actual number of cases ending with the face forwards should be overlooked or misunderstood. Naegele did not believe in the fronto-anterior termination of such cases, except under peculiar circumstances—such as a small head or a large pelvis—but there are probably few accoucheurs of large experience, who take the trouble to observe what passes under their eyes, but have met with such cases, there being no peculiar circumstances whatever to account for them. Drs. Simpson and Barry came to the conclusion that, in the third position, spontaneous rotation occurred in 96 per cent.; while, still more recently, Dr. West found that in 481 cases observed by himself, 15 which were in the third position, were born, or were about to be born, with the forehead in advance; but these included, it must be remembered, cases in which he rectified artificially the position of the head, on the assumption that, had he not interfered, they would certainly have terminated with the face to the pubes. In regard to rotation in the fourth position, the number of cases observed is so small that no reliable data are to be found; but the impression generally prevails, that spontaneous rotation, in such cases, is effected with greater difficulty, and the tendency to fronto-anterior termination is thus proportionally increased.

Face Presentation.—The only other presentation of the cephalic extremity of the child which it is necessary here to consider is that of the Face. This occurs about once in 230 cases. The causes which lead to this unusual occurrence are not well understood, but the initiatory movement which results in a presentation of the face can only be, as is obvious, a movement of extension which, at an early stage of labour, or prior to its occurrence, is substituted for the usual movement of flexion occurring during labour in the ordinary positions of the cephalic extremity. In other words, and to take the most simple view of the matter, cranial are converted into facial positions by a simple movement of the head on its transverse axis. As, in this and other respects, there is a very close analogy between the mechanism of face and vertex presentations, we introduce the subject of the former at this place from a conviction that it will be much more easily understood if studied along with the ordinary cranial positions.

In pursuing the analogy which exists between the face and the vertex, we note, in the first place, that the *obstetrical* differs from the *anatomical* face in including the forehead. The long diameter of the face, therefore, which extends from the centre of the forehead between the frontal protuberances to the tip of the chin, corresponds to the occipito-frontal diameter; and, in like manner, the transverse diameter, from one malar bone to the other, corresponds to the bi-parietal measurement of the cranium. We observe, further, in looking closely at the facial oval, that the pointed chin represents the occiput, while the forehead is, in each presentation, the broad end of the long diameter. A premature and exaggerated movement of extension of the head having thus, as we conjecture, converted a cranial into a facial position, we find that in its descent and birth, it follows the same mechanical laws as those which govern the vertex. Movements are thus executed, which in every stage correspond to those already described, with this important distinction that the relation which they bear to the trunk of the child is in some respects reversed. This will become apparent as we proceed. The face, like the head, and for similar reasons, descends into the pelvis with its long diameter in one or other of the oblique diameters of the brim. There are thus four positions in which we may find the face, according as the presentation may have been originally a cranial position of the corresponding number. It will be observed, however, as a most important distinction, that the numbers of the Mento-Anterior variety do not correspond to the occipito-anterior of the cranium. Each presentation as numbered is, we repeat, supposed to be produced from the corresponding cranial position, by a simple movement on its transverse axis.

MENTO-POSTERIOR,	*First Position,*	Face in Right Oblique Diameter; forehead forwards.
	Second Position,	Face in Left Oblique Diameter; forehead forwards.
MENTO-ANTERIOR,	*Third Position,*	Face in Right Oblique Diameter; forehead backwards.
	Fourth Position,	Face in Left Oblique Diameter; forehead backwards.

The Chin, in all these positions, being looked upon as the mechanical equivalent of the occiput, it follows that the Mento-Anterior varieties in which the front of the child is turned forwards, are the natural terminations of all face cases. This, indeed, is the case in a much stricter sense than in presentations of the cranium, for reasons which will appear presently. We shall, therefore, in the first instance, consider these two positions; and, as the fourth is the one with which we have most frequently to deal, we shall commence with it.

Fourth Facial Position.—Although it is not the usual clinical history of this position, we are entitled to assume it as possible that it may be produced from the fourth cranial position, by a movement of the head on its transverse axis, which brings the chin towards the right ilio-pectineal eminence, the head being extended so as to bend the occiput towards the nape of the neck. The long diameter, indicated by the direction of the nose, lies in the left oblique diameter, with the forehead towards the left sacro-iliac synchondrosis. The finger, on an examination, first reaches the right malar bone, which is the part deepest in the pelvis, and the presentation itself is made out by feeling the nose, mouth, and other features, care being taken not to injure those delicate parts by rough and careless manipulation. The long diameter descends obliquely, with the chin in advance, in proportion to the degree of resistance. The caput succedaneum will be found to involve the right malar bone, the right angle of the mouth, and the parts immediately adjoining. When the face reaches the floor of the pelvis, the chin is directed by the right ischial spine downwards and forwards, along the corresponding anterior ischial plane, while the forehead glides along the left sacro-sciatic ligaments towards the hollow of the sacrum, precisely as in the second cranial position. Having reached the perineum, and probably still retaining a certain degree of pelvic obliquity, the chin now moves forward under the pubic arch. The perineum becomes distended, and the chin having moved sufficiently forwards to release the mental pole of the occipito-mental diameter, the emergence of the head takes place by a movement of flexion, the face being born forwards and upwards as the nose, forehead, vertex and occiput successively sweep over the perineum,—all of which takes place with no greater difficulty than in an ordinary cranial position. The shoulders having descended in the right oblique diameter, the right shoulder is lowest and in front. This part therefore is, in its turn, rotated from left to right, along the anterior plane of the left ischium, while the left shoulder retreats into the hollow of the sacrum; and in this position they pass, as has already been fully described, under cranial positions, a corresponding movement of restitution being at the same time performed by the head. The trunk and breech follow as under ordinary circumstances.

Third Facial Position.—In this the mechanism is precisely similar to that which has just been detailed. The face, however, lies in the right oblique diameter, the forehead being to the right sacro-iliac synchondrosis, and the chin in the direction of the left ilio-pectineal eminence. The left side of the face is lowest in the pelvis, and it is on this that the caput succedaneum forms. The chin descends, and rotation takes place as in the former case, only in the contrary direction, the details of the process being in every respect similar.

First Facial Position.—In this, and in the remaining position, the prominence of the chin is turned backwards. Following the method which we have adopted with the view of maintaining as closely as possible the analogy subsisting between facial and cranial cases, we observe that the Mento-Posterior positions correspond closely with the fourth and third cranial. As in the mento-anterior variety, we may accept the chin as representing the occiput. The First Facial Position is produced from the first cranial by a movement of extension. Its long diameter corresponds, therefore, to the right oblique diameter of the pelvis, the chin being directed to the right sacro-iliac synchondrosis, and the centre of the forehead towards the left ilio-pectineal eminence. The chin thus occupies the situation where the occiput lies in a third cranial position. The part which is lowest in the pelvis, and which the finger feels from the vagina through the anterior wall of the uterus, is the right malar bone. If the os is sufficiently dilated, we may feel through it the bridge of the nose. Carrying the finger, in reference to the position which the woman occupies, downwards and forwards, we may reach the forehead, the frontal suture indicating the path from the bridge of the nose to the anterior fontanelle; while, by passing it in the opposite direction, upwards and backwards, we may feel the ridge of the nose, and the mouth, where the alveolar ridge may be distinguished, and ultimately reach the chin. Should the resistance of the os, at this stage, be such as to cause the development of a caput succedaneum, it will be found to occupy the upper half of the right side of the face, and will generally, to some extent, involve the eye.

With regard to this position, the same observation may be made as in regard to the third of the cranium,—that it *may* terminate in two ways: with the chin towards the hollow of the sacrum; or, by a rotation forwards, which, by bringing the chin upon the right anterior ischial plane, converts it into the fourth facial position, already fully described. Although Smellie, and many writers of merit since him, describe cases of facial presentation in which the chin passes into the hollow of the sacrum, and is born over the perineum, it is only with difficulty that we can admit—for reasons which will be detailed afterwards—a bare possibility of such a termination of labour by the natural efforts. The head, therefore, adopts a course very similar to what obtains in third positions of the cranium. As in the one case the occiput, so in the other the chin descends, prior to rotation, somewhat in advance of the forehead. The fronto-mental diameter being, however, more than an inch less than the occipito-frontal, the same degree of obliquity is not necessary as an essential preliminary to rotation. And it is fortunate that it is so, for the head is already so strongly extended that a further extension seems all but impossible. In the course of the rotation, the chin comes in front of the right ischial spine, while the forehead moves upwards and backwards towards the left sacro-iliac synchondrosis, and the case is thus converted into what we have already described as the fourth position of the face. The rotation, therefore, which converts the first facial into the fourth is, if we read "chin" for "occiput," essentially the same as occurs when the third of the vertex rotates into the second. Less obliquity of the long diameter of the face being required, the rotation of the face takes place with greater ease, which is another reason why we should look upon this as the only natural termination of that position of the face which is the result primarily of a movement of extension of a head occupying the first position of the vertex.

Fig. 129.

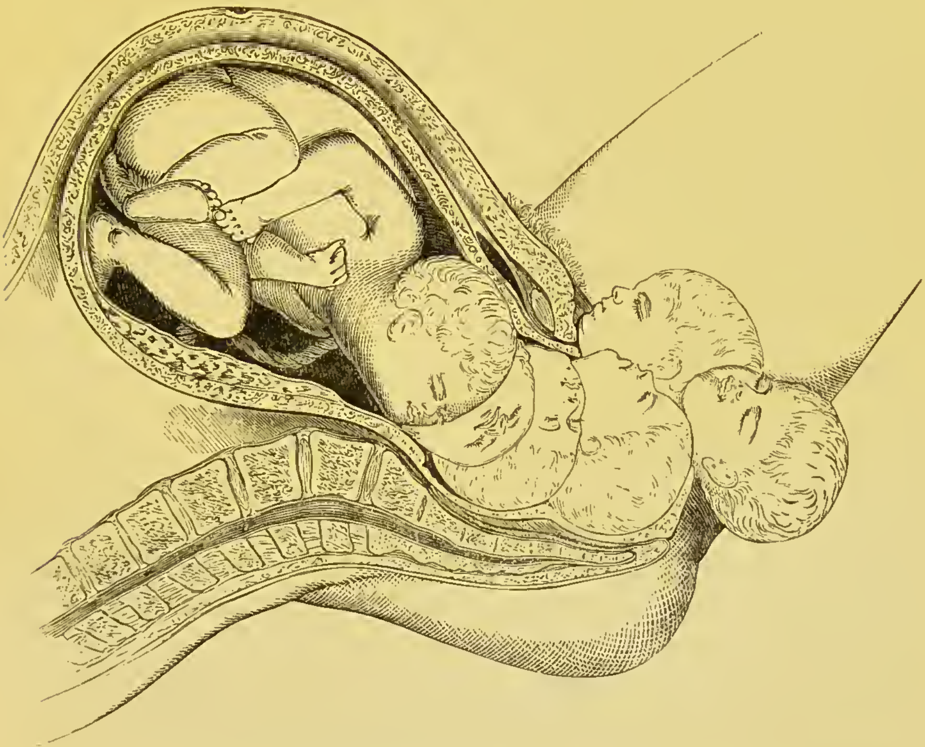


Diagram showing Successive Stages of Rotation and Delivery in the First Facial Position.

The accompanying diagram (Fig. 129) shows the various stages alluded to.

Second Facial Position.—In this position the face is in the left oblique diameter, with the chin to the left sacro-iliac synchondrosis, and the forehead to the right ilio-pectineal eminence. The chin, therefore, lies in the direction which the occiput occupies in the fourth cranial position, and the part which is lowest in the pelvis is the left malar bone. The normal and almost invariable termination of such a case is a rotation analogous to what is observed in the fourth position of the vertex. The chin in this way becomes applied to the left anterior ischial plane, along which it glides as in what we have described as the third facial position, so as to bring it under the arch of the pubes, where the labour is terminated in the usual way.

The relative frequency in the occurrence of the various positions of the face might not unnaturally admit of considerable difference of opinion. For, if the ordinary positions of the cranium, which are so familiar to us, still admit of doubt in this respect, it is not to be wondered at that doubt should still attach to this rare and, as some term it, faulty presentation. If we are correct in assuming, what is very generally admitted, that presentations of the face are the result, in the corresponding positions of the vertex, of a simple movement of the head on its transverse axis, the numbers which we have attached to the various facial positions have a special significance in indicating the original position of the head. But there the numerical correspondence ceases. For, the more closely we look at the relation which the one presentation bears to the other, the more obvious does it become that the chin is mechanically the analogue of the occiput, and that, therefore, the anterior surface of the fœtus is turned forwards in all face cases which are to be regarded as normal. In cranial positions, on the contrary, the back is, as a rule, turned forwards. This, while it so far destroys the analogy between the two classes of cases, establishes between them more important practical points of resemblance; for, as our object is, in any assistance which we may consider ourselves justified in offering, to bring the occiput forward under the pubic arch in cranial positions, so in these also we use what means we can, with the view of aiding in a similar way the descent and precedence of the chin. The aphorism of Roederer might, in fact, if we substitute the word "mentum" for "occiput" be admitted as the leading principle upon which nature conducts all such labours. "Indifferens est quisnam sit capitis positio, modo pars conica atque arctissima, *mentum* nempe. descendat."

In point of relative frequency, therefore, we must speak with some caution. No doubt can exist with reference to the fact that the third and fourth, or mento-anterior, positions are the natural terminations of all face cases. In what proportion of these, third and fourth positions of the cranium have become directly transformed, as we have conjectured, into the corresponding facial positions, it is, and probably from the rarity of the cases always will be, impossible to determine. That such a transformation is possible, no one can deny; that it is probable, we will venture to assert. And, moreover, should it so occur, the change of a fronto-anterior position of the cranium into a mento-anterior of the face may be looked upon as a more favourable termination of a labour than the tedious process already described which, in a certain proportion of such cases, brings the occiput over the fourchette before the face can pass from under the pubic arch. It is on this ground, indeed, that we have considered ourselves justified in taking note of these as distinct positions, and not merely as stages in the course of the other two.

If we take into consideration, moreover, the enormous preponderance of cases in which the cranium or vertex presents with the forehead backwards, we readily admit that it is much more than probable that the mento-posterior positions are, in the earlier stages of labour, the usual positions of the face. The fact again that in cranial presentation the first position occurs in nearly 70 per cent. of the four varieties, suffices to account, on the principle of rotation, for the preponderance at the moment of delivery of fourth over third facial positions. But the fact recorded by Naegele, that the preponderance alluded to amounts only to twenty-two fourth, as against seventeen third, facial positions can only be accepted as confirmatory of his statements as to the frequency of the various cranial positions, by supposing that the third position of the cranium is, as we have assumed, not unfrequently converted by simple extension into the corresponding position of the face. Otherwise, the disproportion would be much greater between the two mento-anterior terminations than he assumes.

Mento-Posterior Termination.—That mento-posterior positions may terminate as such in a large pelvis, or in cases of premature delivery, we may admit as possible. But, if we consider carefully what this termination implies, in the case of an ordinary pelvis and a fully developed head, we find it impossible to conceive a degree of extension which would involve such compression and moulding of the head, as would bring the occiput into relation with the dorsal vertebræ before the chin could reach the posterior commissure of the vagina. We believe, therefore, that the cases upon which the assertions of Smellie and others are founded must have been of the exceptional nature above referred to.

And, if such cases do occur, the mechanism at the moment of birth of the head must be the arrest of the chin at the fourchette, and a movement of flexion which, while relieving the head from its constrained position, brings the mouth, nose, forehead, and vertex successively in a backward direction from beneath the pubic arch.

Operative Assistance.—All presentations of the face were at one time supposed to be abnormal and dangerous. This belief gave rise to different methods of operative interference, which were devised with the view of rectifying the presentation. Of these, the operation of turning found special favour in the eyes of the older accoucheurs, who did not scruple, as a matter of routine, to introduce the hand and turn in all cases in which the presentation was recognised at a period sufficiently early in the labour. Till the beginning of the present century, indeed, this was the mode of procedure which received the sanction of the most eminent authorities. The attention which about this time was directed to the subject of scientific obstetrics soon showed how erroneous was this view, and how greatly increased was the risk both to the mother and child by the operation of turning. But the idea of necessary interference of some kind had got too firm a hold of the professional mind to be at once dispelled, and we therefore find substitutes for the discarded operation sanctioned by the authority of some great names. We find, for example, that it was recommended by Dr. J. Clarke, to allow the face to descend into the cavity of the pelvis, and by steady pressure exercised upon the presenting malar bone during a pain, to push the face into the hollow of the sacrum, and allow the occiput to descend. That Dr. Clarke may have succeeded, as he says, in such cases, we must not doubt; but we confess to great scepticism as to the feasibility of such a proceeding under ordinary circumstances, and we have little doubt that, if we did succeed, the risk to the child would be rather increased than lessened.

Until it had been demonstrated by Naegele, accoucheurs were quite ignorant of the rotation which occurs in the great majority of face cases, whereby, in mento-posterior cases, the chin spontaneously comes forward under the pubes. It was therefore a totally erroneous impression of the nature of these labours which led Baudelocque to suggest, and so many of his followers to adopt, an operation which is scarcely less objectionable than turning. In recommending the operation referred to, he directs us to pass the finger through the os, and along the anterior wall of the uterus over the forehead, and then, rupturing the membranes, attempt to drag down the occiput. This he naturally conceived to be better than to leave the case to nature, believing as he did that all mento-posterior cases could only terminate as such. These and all other similar modes of procedure were at once thrown aside when the fundamental errors from which they sprang were removed by the industry and genius of Naegele.

In face presentations, as they occur in actual practice, we believe the safest rule for our guidance is to avoid interference as far as possible. In occipito-posterior positions of the cranium, we have recommended interference in such cases only as threaten to terminate with the forehead in advance, and the same rule should guide us in our management of the face. When the chin is originally forwards, or has already rotated, no interference whatever is required. It is usually recommended, however, in the mento-posterior positions, to aid the rotation, either by hooking the finger into the mouth, and making cautious traction in the proper direction, or by some other mode of manual interference, with the view of bringing the chin towards the pubic arch, as the face is about to emerge from the pelvis. It is doubtful, however, whether such interference should be sanctioned as the proper routine procedure. So many delicate points have here to be attended to—the direction of the pressure, the time for operation, and the like—that we incline to the belief that nature should, in the great majority of instances, be trusted to. For, if the practitioner of average experience can have but a few cases to observe in the course of a lifetime, it is scarcely to be expected that he can attain such special skill as to act with unfailing precision. While, however, we can bear personal testimony to the possibility of operative rectification of these positions, we would, in ordinary cases of this nature, certainly prefer to watch carefully the process which nature is adopting, and act only in such instances as she may seem to be calling for assistance.

It may be necessary, in facial as well as in cranial positions, to give assistance by manual or operative interference in cases in which delivery is delayed, although the parts are normally situated. Such aid as, under the circumstances, it may seem necessary to afford, is to be employed in each case on the same principles. The only points which are here to be remembered as distinctive, arise from the facts—that in facial positions, the vessels of the neck are, in consequence of the peculiar position, subjected to very unusual pressure, and that the adjacent maternal organs are also likely to be compressed by the manner in which the child's head is doubled back. Both of these conditions should lead us, therefore, to watch the progress of such a case somewhat more strictly than usual, in order, if possible, to detect the earliest indications of abnormal obstruction to delivery and, so soon as this may arise, to relieve it without delay. The forceps, for example, may be employed in such cases, at a period somewhat earlier than is considered necessary in cranial positions, in proportion exactly to the imminence of the danger which we apprehend. Should it, however, occur that the head descends to the floor of the pelvis, and yet no effort be made in the way of rotation, it will be proper to aid the movement in question, having first carefully ascertained the position of the face, and calculated the direction in which our efforts should be applied. Persistent mento-posterior cases may possibly, as has already been said, terminate as such, if the child be premature or putrid, or the pelvis of unusual capacity; but if, owing to the disproportion of parts, or some other special cause, rotation should not be effected, the inevitable result is such obstruction as may be called insurmountable, and in these instances the perforator and the crotchet may be required before the relief of the woman is effected.

Although but four positions are above described, it may be said of face, as of cranial positions, that there is no possible diameter of the brim which may not be occupied, in some case or other, by the long diameter of the face. And, in regard to the situation of the parts after they have descended in the cavity of the pelvis, it may be further noted, that certain intermediate or modified presentations may possibly occur. Brow presentations, for example, are described by many writers, and, in so far as we may judge from comparative measurement and mechanism, are to be admitted as possible. They must, however, be always looked upon as of the most unfavourable nature, and one of the most formidable objections to Baudelocque's operation was the risk of thus converting an unfavourable presentation into one which was, perhaps, even more so, should the attempt at artificial rectification be arrested midway in its course. A thorough knowledge of the mechanism of ordinary labour will be the best guide to the management of any such exceptional cases as may offer themselves in the course of practice.

We have attempted throughout, in the description which has been given of the four positions of the face, to indicate the strong analogy which exists between them and the ordinary positions of the cranium, which are so familiar to all. The prominence of the chin, therefore—be it once more remarked—is the analogue of the occiput. This is more clearly shown in the following tabular statement, which is drawn up with the view, not only of showing the relation between facial and cranial positions, but also of enabling the student to store the facts in his memory, in such a form as may be most available for practical emergencies in any presentation of the cephalic extremity of the child.

TABULAR ARRANGEMENT OF THE POSITIONS OF THE CEPHALIC EXTREMITY OF THE FŒTUS.

CRANIUM OR VERTEX.		FACE.	
OCCIPITO-ANTERIOR POSITIONS.	I. In Right Oblique Diameter; forehead to right sacro-iliac synchondrosis.	MENTO-POSTERIOR POSITIONS.	I. In Right Oblique Diameter; forehead towards left ilio-pectineal eminence. *Rotates into the 4th.*
	II. In Left Oblique Diameter; forehead to left sacro-iliac synchondrosis.		II. In Left Oblique Diameter; forehead towards right ilio-pectineal eminence. *Rotates into the 3rd.*
OCCIPITO-POSTERIOR POSITIONS.	III. In Right Oblique Diameter; forehead towards left ilio-pectineal eminence, *Usually rotates into the 2nd.*	MENTO-ANTERIOR POSITIONS.	III. In Right Oblique Diameter; forehead to right sacro-iliac synchondrosis.
	IV. In Left Oblique Diameter; forehead towards right ilio-pectineal eminence. *Usually rotates into the 1st.*		IV. In Left Oblique Diameter; forehead to left sacro-iliac synchondrosis.

In Cranial Positions, therefore, *the third rotates into the second, and the fourth into the first;* while in Facial, *the second rotates into the third and the first into the fourth.*

CHAPTER XIX.

PELVIC PRESENTATIONS.

The Practice of the Past.—The Pelvis a Natural Presentation.—Dorso-Anterior and Dorso-Posterior Positions.—Breech Presentation; Four Positions of.—FIRST POSITION OF THE BREECH: *Rotation: Passage of the Buttocks: Descent and Birth of the Shoulders: Difficult Progress of the Head, and Mechanism of its Expulsion.*—SECOND POSITION OF THE BREECH.—THIRD POSITION OF THE BREECH: *Birth of the lower portion of the Trunk, and of the Shoulders: Rotation of the Face Backwards, and Mechanism of the Birth of the Head; Exceptional Terminations.*—FOURTH POSITION OF THE BREECH.—*Special Risk of Pelvic Presentations.—Diagnosis and Peculiarities.—Knee and Footling Cases.—Management of Pelvic Presentations.—Nature of Assistance to be rendered.—Use of the Fillet, Vectis, and Blunt Hook.—Indiscriminate dragging on the Lower Limbs to be avoided.—Treatment where Arms pass up alongside of Head.—Management of the Funis.—Indications of impending Death of the Child.—Manipulation for effecting speedy Delivery of the Head.—Use of the Forceps.*

ALTHOUGH the writer of the obstetrical memoranda which were attributed to Hippocrates recognised the oval form of the child in the womb, and illustrated the impossibility of delivery in cross birth by the graphic simile of the olive in the neck of an oil jar, he, strangely enough, as has already been mentioned, omitted to perceive the full force of his illustration. For, as every oval has two ends, he ought to have concluded that the fœtal oval could pass naturally with either of these in advance, as the olive might be extracted from the jar. Failing to observe this, however, the ancients believed that presentations of the pelvic extremity were abnormal, and should in all cases be rectified by artificial aid. The result of such a mode of practice as this points to—which obtained throughout a period of many centuries—is looked at by the modern obstetrician with horror, on account of the fearful sacrifice of human life which such a procedure must have involved. There is nothing, indeed, in the history of Midwifery comparable to this, and the idea of turning by the head in all cases of pelvic presentation is one so repugnant to every principle of modern obstetrics, that it is difficult to conceive by what perversion of reason a blunder so fearful could have been perpetrated. Certain it is that, until the revival of anatomy by Vesalius, and even for some time after the art of printing had been discovered, the practice recommended in pelvic presentations was that which has just been indicated as dating from the time of the Ancients.

It is to Ambroise Paré that we owe the correction of this monstrous error, and from his day these presentations have always been recognised as natural. Although much more dangerous to the child, they are attended with no increase of risk to the mother. While, however, we prefer to consider presentations of the Pelvic Extremity as natural, it must be noted that many writers have thought it necessary to classify them as preternatural, an opinion which has given rise to much controversy, an analysis of which would serve no good or useful purpose. The pelvic end of the fœtus is made up of certain anatomical elements which may present themselves in various combinations. The ordinary presentation is that in which the fœtus preserves its usual intra-uterine attitude, with the limbs flexed, but with its axis inverted, so that the presenting part is the Breech. If, however, the inferior extremities become separated from the trunk, and thus occupy the inferior segment of the uterus, we may have other presentations which fall under the same category, such as presentations of the knees or of the feet, or of one knee or one foot. The classification, therefore, of possible positions may be multiplied by a little ingenuity to such an extent as to render the subject an extremely complicated one, and its study a wearisome task. Here, again, we owe much to the indefatigable industry of Naegele. For it was he who first showed that, although we may subdivide the positions *ad infinitum*, all pelvic presentations may, in so far as the mechanical phenomena of labour are concerned, be reduced to two classes according as the dorsal or abdominal surface of the child is turned forwards within the womb. We shall now proceed, therefore, to the description of the positions of the Breech, which will suffice for all possible presentations of the pelvic extremities. Certain peculiarities attach to cases of knee and footling birth, which, being of a practical nature, will receive a brief notice in the proper place.

The structures which form the breech of the child are of a much softer and more yielding nature than the cranium, and are, therefore, within certain limits, more plastic and susceptible of adaptation to the parts through which they have to pass. Parturition is not the less on that account governed by fixed mechanical laws, according to which the parts enter, pass through, and emerge from the pelvic and parturient canal. To the consideration of these we now pass. In presentation of the breech we find no less marked a preference for the oblique diameters than in the case of the cranium, so that the child assumes a position with its back or belly forwards, and turned at the same time either to the right or to the left. The two main divisions of all such cases then are, according to Naegele and subsequent observers, Dorso-Anterior and Dorso-Posterior positions, the former being the more frequent in the proportion of three to one. As each of these implies a possible position of the transverse or long diameter of the breech in either oblique diameter of the maternal pelvis, we may here, as in cranial and facial cases, detail four Positions of the Breech as follows :—

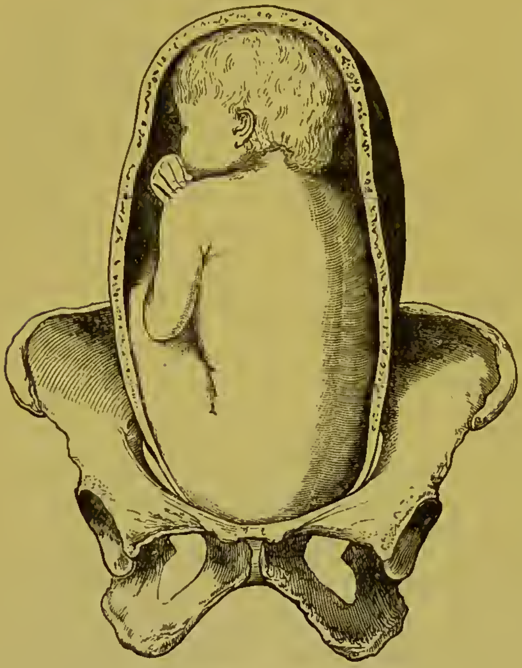
DORSO-ANTERIOR,	*First Position.*	Breech in Left Oblique Diameter; left trochanter forwards.
	Second Position.	Breech in Right Oblique Diameter; right trochanter forwards.
DORSO-POSTERIOR,	*Third Position.*	Breech in Left Oblique Diameter; right trochanter forwards.
	Fourth Position.	Breech in Right Oblique Diameter; left trochanter forwards.

Diagnosis of Breech.—The breech is recognised, on a digital examination, by the ischial tuberosities, between which the genital organs, male or female, may be distinguished. As the parts are, however, frequently much distorted by what is equivalent to the caput succedaneum, it is not always so easy for the beginner to recognise the presentation as he may perhaps imagine. He may, in a hurried and imperfect examination, very readily mistake the tuber ischii, which his finger first touches, for the prominence of the shoulder, and the female genital organs for the fold of the axilla. It is well, therefore, that in every case he should make a leisurely examination, in order to ensure the accuracy of his diagnosis. The genitals, occupying a situation between two osseous prominences, one of which is usually considerably lower than the other, can scarcely be mistaken; and, in the case of the male, the scrotum is generally tumefied. But, if any doubt should arise, this is set at rest if, in addition to the parts named, he recognise the anus, the point of the coccyx, and the unequal osseous surface of the back of the sacrum. To this last point Cazeaux attached considerable importance. At the commencement of labour, or even before it has come on, it is often possible to recognise a breech presentation by palpation of the abdominal tumour, which, when the walls of the belly are thin and relaxed, enables us to make out the general outline of the child, with the rounded resistant cephalic extremity turned towards the fundus and inclined a little to either side. The pulsations of the fœtal heart are heard on a somewhat higher level, near the umbilicus. The absence in the vagina of the firm and smooth globular head, which generally occupies the lower segment of the uterus, would further corroborate such observations as the above. The presentation is, at this stage, higher than usual, and often beyond the reach of the finger; but, in knee and footling cases, the knee or heel may be felt lying against the most dependent part, and retreating before the pressure of the finger. In its general shape and external appearance, the uterus is not sensibly altered. Should the membranes be already ruptured, the appearance of meconium is, although but an uncertain sign, always an important one.

Frequency of Pelvic Presentation.—Presentation of the pelvic extremity is by no means a rare occurrence, as it is met with once in about 45 mature births; and, in premature delivery, it is, for reasons formerly stated, much more frequent. Of 80 pelvic presentations, observed by Dubois, 54 were ordinary breech positions, and in 26 the feet descended in advance. Madame Lachapelle only saw the knees presenting once in 3,445 instances of labour, and in the statistics of the Lying-in Hospitals of Würzburg and Prague, we find but one case in 9,274. The breech is, however, not only the most frequent but the most favourable of the pelvic presentations. For, although at first sight it might appear that a footling or knee might, on the principle of the wedge, be a more favourable arrangement mechanically, an observation of the whole process at once shows that this is not the case. The broad breech, increased in bulk by the flexion of the thighs, performs a most important function in dilating the passages for the safe and rapid progress of the head, during the latter and more critical period of the labour; and, as it is very evident that this will be more effectively done by the breech than by the footling presentation, the former is, from a mechanical point of view, undoubtedly the most favourable.

First Position of the Breech.—Of all the possible positions of the pelvic extremity, this, which is shown in Fig. 130, is the most common. In it, the transverse or long diameter of the breech occupies the left oblique diameter of the brim, so that, as the back of the fœtus is turned forwards, it is the left ischial tuberosity which is lowest in the pelvis and upon which the finger impinges on examination. Backwards, and in the direction of the left sacro-iliac synchondrosis, another similar projection is reached, and between the two, in a direction corresponding to the right oblique diameter, is a sulcus or depression, in which may be recognised, from before backwards, the coccyx, the anus, and the external genital organs. In proportion to the resistance offered to the breech in its descent, there is an increase in its obliquity, which brings the left buttock still more in advance, precisely as occurs in the descent of the occiput. When the breech reaches the floor of the pelvis, therefore, it is the left hip and posterior surface of the left thigh which come upon the anterior ischial plane of the right side, while the right hip passes behind the left ischial spine and comes into contact with the sacro-sciatic ligaments of the same side.

Fig. 130.

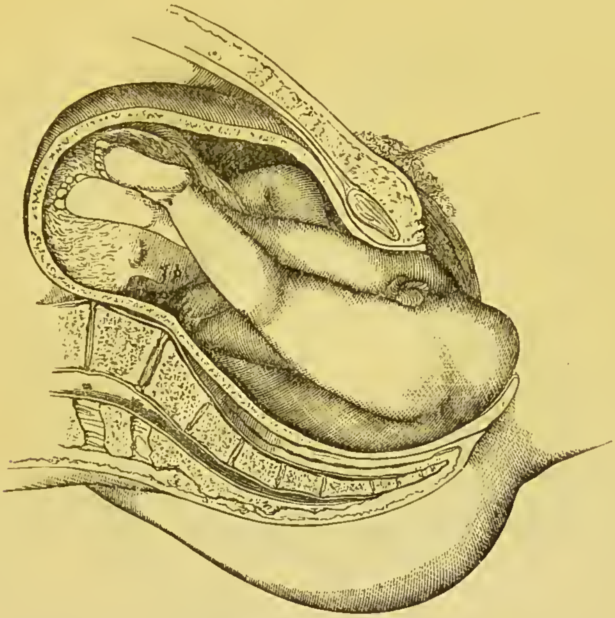


First Position of the Breech.

Rotation.—A rotation now takes place which is in every respect analogous to the cranial rotation already described, the left buttock gliding downwards, forwards, and to the left along the ischial plane and the obturator internus, while the right buttock performs the corresponding movement from left to right towards the hollow of the sacrum. There is not in this case—as a comparison of the relative measurements will show—the same imperative necessity for rotation which obtains in the case of the head. But, in its birth, it follows the same mechanical law, with this difference only—that the rotation is, in the case of the breech, more rarely complete into the antero-posterior diameter than occurs when the head is the presenting part. It might be supposed, following the analogy of the mechanism of the occipito-anterior positions of the vertex, that the left buttock passed upwards and forwards under the pubic arch, while the right swept over the perineum. Such, however, is not the usual mechanism of the process. The left buttock, indeed, moves forwards to the arch, but at this point it is arrested and forms a centre, upon which the right buttock describes the arc of a circle, from before backwards on the distended perineum, so that, in the act of birth, it takes precedence of the left, which passes immediately afterwards (see Fig. 131). The long diameter still preserves to the last a certain amount of its obliquity, so that the right buttock is directed a little to the left of the middle line, and, so soon as it has passed, the feet and knees slip down, and with the movement of extension of the thighs the lower part of the trunk is born. The belly of the child thus lies towards the right thigh of the mother. No marked movement of restitution occurs at this stage, because the shoulders are descending in the same oblique diameter as was occupied by the breech. If, however, the trunk of the child does not participate in the rotation of its pelvis, a certain degree of restitution may occur to relieve the twisting of the vertebral column.

The thorax now occupies the pelvic cavity. The superior extremities, if normally situated, are in contact with the anterior and lateral parts of this region of the trunk. The long diameter of the shoulders, occupying like the breech the left oblique diameter of the pelvis, descends under the influence of successive pains. When the resistance of the pelvic floor is fully encountered, a movement is executed in every respect similar to that which is observed in the passage of the breech. The left shoulder comes forward towards the summit of the pubic arch, but is there arrested, so that the right sweeps over the perineum, and is born in advance of its fellow, as shown in Fig. 132. It happens, not unfrequently, that one or both of the arms slip up during the descent of the trunk, and become applied to the sides of the child's head (see Fig. 133), an accident which, in a pelvis below the average in its measurement, may give rise to considerable obstruction and delay. The original attitude of the head

Fig. 131.

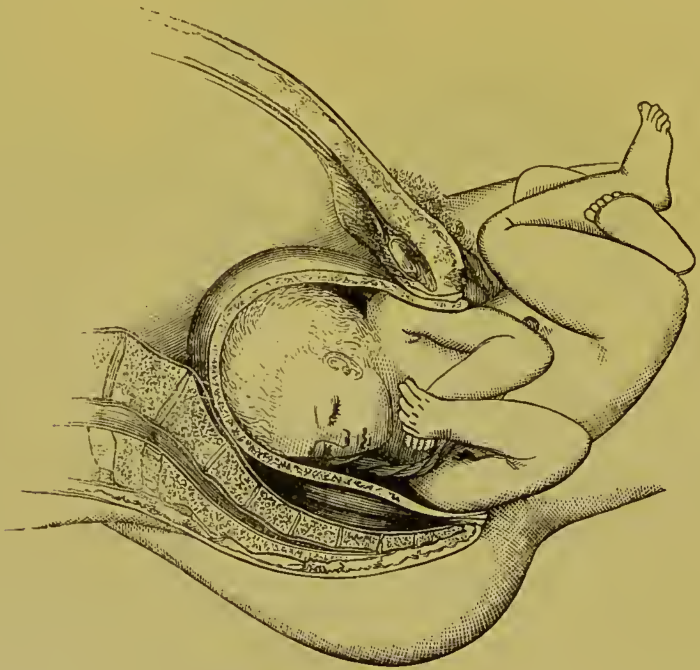


Birth of the Breech.

with reference to the trunk, in all breech cases, is with the chin flexed towards the sternum, which permits of the expulsive force being communicated to the trunk to the greatest mechanical advantage. Any movement of extension which may occur, tends not only to disturb the conditions upon which a speedy labour depends, but may also, by allowing the hands to slip between the chin and the sternum, and thence to the side of the head, interpose a very serious barrier to the accomplishment of the labour, more especially if, as sometimes happens, one becomes locked behind the head, and between it and the pubic bones.

As the shoulders are passing through the outlet of the pelvis, the head descends in the right oblique diameter. The point of essential distinction between pelvic and cephalic presentations becomes manifest at this stage. In the latter, the difficulty terminates with the birth of the presenting part, but in the former the real difficulty commences at the corresponding stage. The passage of the breech is not attended with any special difficulty, nor is the passage of the shoulders long delayed. But, instead of the difficulty ceasing with the birth of these parts, it becomes increased, and the really anxious and critical time of the labour now begins. For not only has the most unyielding part of the fœtal oval still to pass, but it has to pass under circumstances

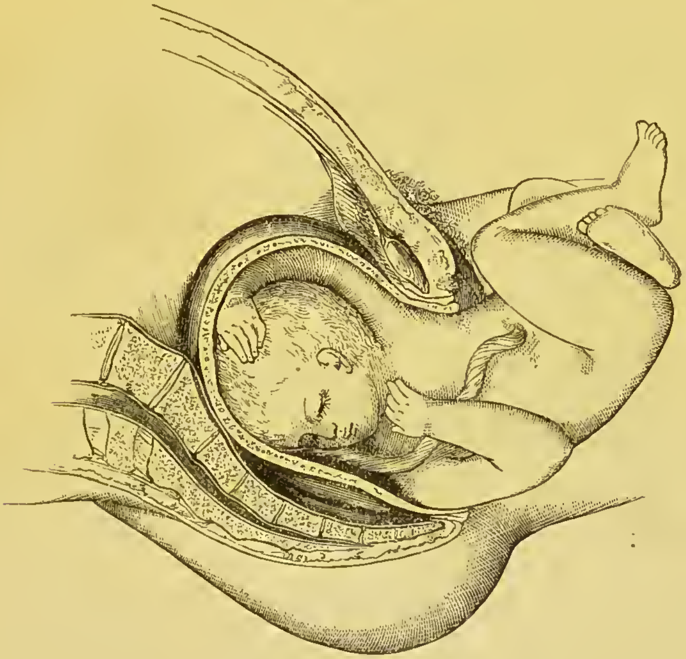
Fig. 132.



Birth of the Shoulders.

which necessarily imperil the life of the child. Beyond a certain point, indeed, delay involves death to the child, so that the skilful management of this stage may be said to be one of the most important practical duties of the accoucheur. A cause which at this moment increases the risk, is the failure of expulsive force. This does not imply so much a failure of expulsive action as that, the uterus being now nearly empty, its propulsive energy is brought to bear upon the head at great mechanical disadvantage; and it is difficult to see how, but for the contraction of the vagina, of the respiratory muscles, and of those at the floor of the pelvis, nature could ever complete a case of pelvic presentation. In the position at present under consideration, the head descends with the forehead turned towards the right sacro-iliac synchondrosis, and a little in advance. The occiput is turned towards the left ilio-pectineal eminence and, after rotating towards the sub-pubic arch, is there arrested until the chin, nose, forehead, and vertex sweep successively forwards and upwards over the distended perineum. Fig. 134 shows the head in this position immediately prior to the final act which terminates the second stage of labour.

Fig. 133.



Arm Displaced Upwards.

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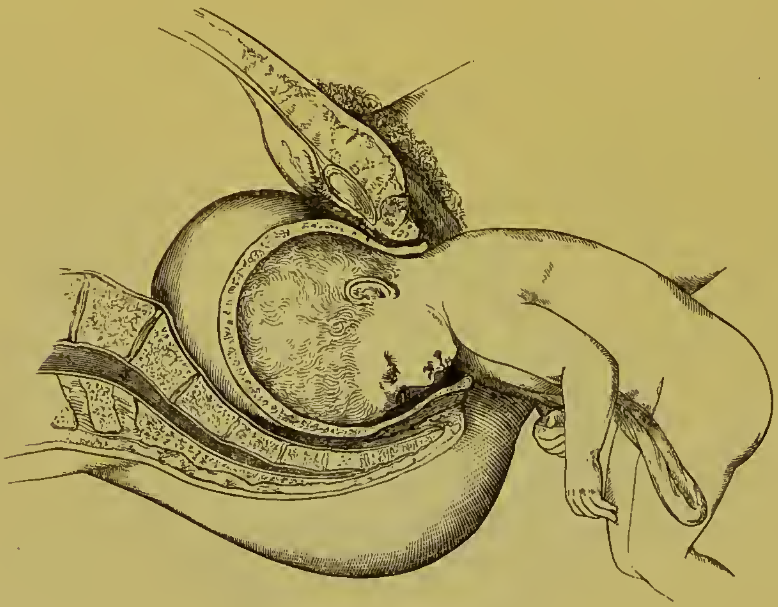
Second Position of the Breech.—In this, the position is also dorso-anterior; but, instead of occupying the left as in the position above described, the pelvis descends in the right oblique diameter. It is therefore the right ischial tuberosity which presents, and the right buttock which descends in advance as far as the pubic arch, being directed towards it by the anterior inclined plane on the left side of the pelvis. The left hip sweeps over the perineum, and the shoulders descending in the right, and the head in the left oblique diameters, are successively expelled by a mechanism which is in all respects identical with that which obtains in the first position, only in the contrary direction as regards the various rotatory and other movements. At first it seems strange that this should be less frequent than the first position, and that nature should prefer the left oblique diameter, in breech cases, to the right; and this too would almost seem to throw doubt upon the opinion we have expressed that she prefers the right oblique in cranial presentations, in order to avoid the left which is encroached upon by the rectum. But, even here, if we watch the case to a termination, we find nature apparently guided in a majority of cases by the self-same law. For, as we have already seen, the really critical and important moment of a breech case is that during which the head passes through and out of the pelvis; and it is on this account that, in the more common first position, the head is in the favourable diameter; whereas, in the second, the head descends in the left, which is, as statistics would seem to show, more dangerous to the child, probably because detention of the head is more likely to occur.

Fig. 134.



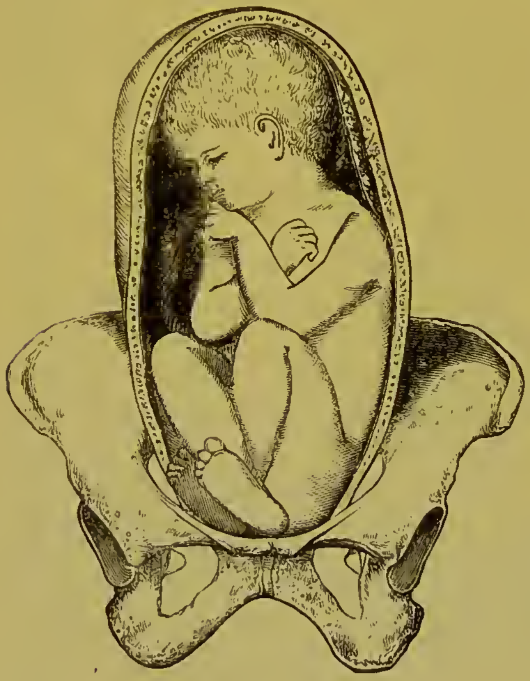
Birth of the Head.

Third Position of the Breech.—Of 161 pelvic presentations occurring at Heidelberg, 121 had the back, and 40 the belly of the child turned forwards. This gives as nearly as possible a preponderance in favour of the two first positions, already set down at three to one. The third and fourth or Dorso-Posterior positions, then, are of comparatively rare occurrence.

In the Third Position, which occurs less frequently than any of the others, the breech lies in the left oblique diameter, which, as the back is turned towards the vertebral column of the mother, brings the right tuber ischii to the front, and deeper in the pelvic cavity. When it reaches the floor of the pelvis, the corresponding buttock glides along the right ischial plane, and attains the summit of the pubic arch, where it is arrested until the left ischium sweeps over the perineum, when the belly of the child is born towards the mother's left thigh. The shoulders descend in the same oblique diameter, and are expelled pretty much as in a dorso-anterior position. The head then enters the pelvis in the right oblique diameter, with the occiput towards the right sacro-iliac synchondrosis. In the great majority of cases, the termination of this position is by a rotation which brings the occiput from the sacro-iliac synchondrosis to the obturator foramen on the right side and the forehead from the obturator foramen to the sacro-iliac synchondrosis on the left side. In a word, the rotation is the same which converts a third into a second position of the cranium. This rotatory movement has, in some cases, been observed to take place at an earlier period in the labour. When that occurs, the movement takes its direction from the original rotation, which brings the right buttock in advance. It passes then, from right to left, into the conjugate, and a little beyond it, and ultimately continues the movement in the same spiral direction, until the belly of the child looks almost directly backwards. The trunk, in this case, participates in the rotation of the breech, but if it does not so participate, the head itself, when subjected to the resistance of the pelvis, performs the extensive rotation which we have described.

Cases are occasionally observed in which the rotation above described does not take place, and the head comes into the world with the occiput turned backwards. The usual course in such a case is that the head descends in the pelvis in a strong state of flexion, with the forehead and occiput turned to the anterior and posterior extremities, respectively, of the right oblique diameter. The usual movement of rotation brings the occiput along the right sacro-sciatic ligaments towards the hollow of the sacrum, and the forehead from left to right, under the sub-pubic arch. The original movement of flexion is then continued, so as to bring the face, forehead, and vertex, in succession, from behind the symphysis, while the occiput, around which, as a centre, this movement has been executed, is the last part to escape. It would also appear, from cases which are recorded upon good authority, that the head in this position may escape by a movement which is not one of flexion, but of extension. The occiput, in these rare instances, would seem to have preceded the forehead in its descent; the chin rests upon the lower part of the symphysis, and the occiput, vertex, forehead, and face successively emerge over the perineum, the depression between the chin and the trachea being the centre upon which the movement of extension occurs.

Fig. 135.



Fourth Position of the Breech.

Fourth Position of the Breech.—Of the two dorso-posterior positions of the breech, it is this which is more frequently met with. The long diameter of the hips occupies the right oblique diameter of the brim, so that, while the child sits, as it were, upon the brim of the pelvis, its anterior surface looks forward, and to the right. The left trochanter is towards the left ilio-pectineal eminence, and it is consequently the left tuber ischii which is forwards and stands lowest in the pelvis. The breech and shoulders descend as in the third position, each performing the same limited amount of rotation and external restitution; the head then arrives in the pelvis, in the left oblique diameter, the chin being in front of the right, and the occiput behind the left ischial spine. The forehead then rotates backwards, while the occiput travels as in the corresponding positions of the vertex, from the left sacro-iliac synchondrosis, onwards along the left side of the pelvis, until it arrives at the sub-pubic angle, where it is arrested, and the face, forehead, and vertex sweep, as in the preceding position, forwards over the distended perineum. The same exceptional cases may also occur as in the third position, and we should therefore be prepared for the possible occurrence either of complete rotation before the head descends to the brim, or of one or other of the occipito-posterior positions which have been described.

All presentations of the breech tend to terminate more irregularly than those of the head. The birth of the nates is perhaps attended with even less difficulty than that of the head in a cranial presentation, but the real difficulty, in a breech case, is the speedy and safe passage of the head. And it is indeed remarkable, not only in regard to the first position, but also the fourth or more frequent of the two dorso-posterior positions, that the head, in its descent by the normal path, avoids that oblique diameter which is contracted by the rectum. But whether this occurs or not, pelvic presentations are attended by special and greatly increased risk, which is greater, moreover, in regard to knee and footling cases, than when the breech presents.

Knee and Footling Cases.—Something must here be said in reference to the diagnosis of knee and footling cases, but, as regards the mechanism according to which labour under such circumstances is accomplished, no special description is necessary, as it differs in no material respect from what has been described in regard to the breech. The mechanism of all pelvic presentations is, in other words, essentially the same. Very little can be recognised with certainty, until the rupture of the membranes enables us to distinguish the various parts. The form of the bag of waters, upon which some have laid great weight in a diagnostic point of view, may certainly give rise to suspicion, although it can never by itself be of much importance. In all pelvic presentations, it is, as a rule, more pointed, and projects further into the vagina. In footling cases, the bag is long and sausage shaped, and through it the foot or feet may be felt. When the membranes ultimately give way, the discharge of the liquor amnii does not take place with such a gush as in cranial positions, but on the other hand it is more continuous, and the drainage more complete. In cranial presentations, the head, acting like a ball-valve, hinders the liquor amnii from escaping, except in small quantities, in the intervals between the pains; but, when the irregular pelvic extremity presents, a more complete escape is permitted, which, by bringing the uterus to bear more powerfully and directly upon the surface of the child, no doubt increases the risk of its life. The foot is very liable to be mistaken by beginners for the hand, for, although any one could distinguish between the two with the eyes shut, if he could bring the whole of his fingers to bear upon it, it is a very different matter when he attempts to recognise a part which can only be reached by a couple of fingers, and that possibly with difficulty. The length of the digits, and the mobility of the thumb as compared with the great toe, will prevent the possibility of doubt when we can recognise these points, but under circumstances of unusual difficulty, this may be impracticable. No single anatomical feature of the foot is, in difficult cases, so characteristic as the prominence of the heel. The dorsal surface of the hand may be mistaken for the instep, and the fingers for the toes, but on the other side of the joint there is nothing in the hand which can be compared to the projection of the heel. If, therefore, we can pass one finger over the dorsum of the foot, and another over the heel, which enables us to grasp the extremity of the limb like the head of a crutch, we may be perfectly confident that it is a foot and not a hand with which we have to deal. And we would here observe, parenthetically, that this is one of many points, in regard to which the young practitioner should lose no opportunity of perfecting the *tactus eruditus;* for a mistake here, which is acted upon by operative or other interference, may bring discredit upon him, and, what is worse, may directly lead to the most disastrous results for his patient. The determination of the position of the fœtus from a single foot is a matter in reference to which some doubt may exist. The general direction of the toes will however indicate the abdominal surface of the child, and if both feet should present, this is much more certain. We may, however, have to wait for the descent of the breech before we can be certain to which of the four positions it is to be referred. A single foot should always, if possible, be identified as right or left, which is very easily done, if it be sufficiently within reach, by placing the palm of the hand to the sole of the foot in the same manner as is pursued in identifying a single hand, as will be more particularly described afterwards.

Dangers of Pelvic Presentation.—The risk to the mother in presentations of the pelvic extremity is in no way increased; for, admitting that the opinion generally expressed in regard to the tardy completion of the first stage is correct, we may assume that this is compensated for by the comparative ease with which the child makes its way through the passage. But the figures already quoted, which are confirmed by the experience of every one, show only too clearly that the risks to which the child is exposed are enormously increased. It is equally certain—as, indeed, is further indicated by the figures alluded to—that the risk is not the same in all cases of pelvic presentation, but is greatly increased in those cases in which the thighs are extended, and not flexed upon the trunk. The cause of this is to be found, as has already been observed, in the inefficient manner in which the canal is thus dilated for the passage of the head, which delays the completion of the labour at the critical moment, when, all being born but the head, it is arrested in the pelvis until the life of the infant is destroyed by suffocation. In an ordinary breech labour, the more complete dilatation of the parts reduces this risk to a considerable extent, but, even under the most favourable circumstances, the risk is, as compared with cranial births, enormously increased. And it is none the less certain that, by prompt and skilful measures, the accoucheur will often have the gratification of saving lives which, if left to nature, would have inevitably been sacrificed. A thorough knowledge of the mechanical phenomena above detailed, is the first essential qualification which may lead to skill and judicious management in the treatment of all cases of pelvic presentation. In order thoroughly to understand the subject, however, we must view it under various aspects. While we have no difficulty, for example, in recognising that, in many instances, assistance is necessary, we must not overlook the fact that injudicious interference is bad. We have to consider, therefore, not only what to do, but what *not* to do; for, unfortunately, many errors in practice have been committed, and as some have had the sanction of great names, it is doubtful whether on this subject sound practical views are entertained as invariably as they ought to be.

Treatment of Pelvic Presentation.—Long after the preposterous idea of Hippocrates, alluded to in the beginning of this chapter, was exploded, views erroneous, but erroneous in a minor degree, obtained in reference to the treatment of presentations of the pelvic extremity of the child. We thus find Williams, Hunter, and Smellie bringing down the feet when the breech presents, as a matter of routine, but this, happily, has long fallen into disuse, except in difficult cases, as we shall see.

It may be inferred from what has already been said, that the duties and responsibilities of the accoucheur are, in the case of a pelvic presentation, greatly increased. In a cranial case, while all goes well, we look to the issue without a shadow of apprehension, and we absent ourselves, from time to time, without any consciousness of neglecting or evading a duty. But, when the pelvis presents, all is altered in this respect. The risk, be it again repeated, is a fœtal, and not a maternal one; but, as we cannot tell the moment at which our assistance may be required, we must be much more strict and continuous in our attendance, and, so soon as the breech has descended in the pelvis, we must not leave the bed-side of our patient until the delivery has been completed. This assiduity on our part does not involve, of necessity, any interference with the natural process, except at the last part of the second stage, when a little assistance in the passage of the head is almost always justifiable.

Having fully satisfied ourselves of the exact position of the fœtus, and thus recognised the manner in which the mechanism will probably be conducted, we simply wait and watch the issue. If nature takes the ordinary course, and the breech descends, whatever its original position may have been, in a satisfactory manner, we do not presume to interfere, by in any way hastening or aiding the labour. At this moment, there is no special risk to the child, and, indeed, the slower the dilatation of the passage, the more effectual is that dilatation likely to be, and the safer and more rapid the subsequent birth of the head. So soon as the buttocks and lower limbs are born, we know that the critical period approaches, and some anxiety is not unnaturally felt as to the subsequent progress of the case, as a condition now comes into operation, constituting one of the special dangers of pelvic births. This is compression of the umbilical cord, which, as the thorax approaches the ostium vaginæ, becomes jammed between the pelvic wall and the unyielding cranium—a state of matters which, if complete and continuous, rapidly destroys the child by interrupting the placental circulation. We should, at this stage, pull down a loop of the cord, thus obviating the probability of obstructed circulation by overstretching, and at the same time guide it, if possible, in the direction of either sacro-iliac synchondrosis—where the risk of pressure is least—choosing, if choice there be in the matter, that sacro-iliac synchondrosis which corresponds to the side of the child's head. Much useful information as to the prospects of the case is afforded by grasping the cord with the fingers, so as to feel its pulsation. So long as this remains quite vigorous, the case is to be left entirely to nature; but we must repeat the observation frequently, as the descent of the head may expose the cord quite suddenly to fatal pressure—a fact which it is of the highest importance immediately to recognise. The persistence or failure of funic pulsation are, in fact, the chief indications as to the necessity for operative interference.

Exceptional circumstances, no doubt, may arise to call for assistance at a stage even earlier than that which we are describing. Long detention of the breech within the cavity, owing to disproportion of the fœtal or maternal parts, or to *inertia uteri*, may call for action at an unusual period, on the same general principles as will afterwards be detailed as applicable to the case of obstructed cranial labour. The operative procedure proper to breech cases is, however, peculiar; and, if we fail, by the use of ergot or otherwise, to arouse the dormant energy of the uterus, or should we recognise an obstruction which natural efforts cannot overcome, we must be prepared to act with a view to speedy delivery. The forceps, being specially constructed for application to the fœtal head, is not generally available.[1] The vectis, however, applied over the flexure of one thigh, while the hand of the operator is applied to the other, may possibly succeed; and the blunt hook is an instrument which has been frequently recommended in the management of such cases. No one can doubt the mechanical power of these, and especially of the blunt hook, but the danger of bruising, and even lacerating, the parts of the fœtus is not inconsiderable, so that such means should, if possible, be avoided. When the child is dead, and much force has to be employed, the blunt hook, and even the crotchet may be applied—the use of which instruments will be more particularly detailed when we come to consider the subject of obstetric instruments under a special section. By the fingers alone, introduced over the groin upon the flexure of the thighs, the breech, in a very considerable proportion of ordinary cases, may be drawn down under the pubic arch, the operator remembering always, and imitating, as far as possible, the natural mechanism of the act. This is in all cases to be preferred as the safest, but, should it fail, a second mode is still available, which is much safer than, and therefore to be preferred to, any variety of instrumental delivery. What is required for the operation is a handkerchief, or, what we have found even more satisfactory, a skein of cotton yarn. One end of this is to be passed between the thighs and the abdomen, in the flexure of the groins, to the corresponding point on the other side, where it is to be seized and pulled down. In this we have a powerful fillet so adjusted that we use a very considerable traction force without any risk of injury. It is sometimes possible—and the more so when the breech is high in the pelvis—to break up the presentation, by pulling down one leg. Should we employ this subsequently for the purpose of traction, great care must be taken not to use too much force, otherwise dislocation or fracture may be readily enough produced.

The rule, however, is, as has been said, that we should interfere in no way whatever until the breech and lower part of the trunk have been born, when we direct our attention assiduously to the state of the cord. When the breech is born, and the legs lie between the thighs of the mother, and, in footling cases, even before the passage of the breech, an almost irrepressible desire may possess the accoucheur to grasp the limbs and to bring the labour to a rapid termination. Such, it is to be feared, is not unfrequently the practice of those who have not taken some pains to master the mechanism of pelvic births. In many cases, doubtless, the result may be what is desired, but the hasty termination of the labour is thus purchased at an increased risk to the child. For the result of thus forcibly dragging down the body of the child is to separate, unless the uterine contractions are unusually strong and continuous, the chin from the sternum, against which it has been hitherto applied. The consequent extension of the head may thus result in a faulty position; or, if the traction be continued, it may descend without undergoing the natural movement of rotation proper to the original position. The possible result of this is only too obvious, and arises from the fact that under such circumstances the child's head is delayed in the pelvis longer than if we had left the case to nature, and thus, at the moment of all others at which speedy delivery is desired, the head is detained, and the child is suffocated, owing to the ignorance of the operator. But this is by no means the only manner in which his misplaced energy may defeat its own ends, for the separation of the chin from the sternum leaves a gap into which the hands are liable to slip from their position in front of the thorax, and from thence again to the sides of the head, which may thus, in a tight pelvis, be jammed by the double wedge. This, then, is an obvious error in practice which the young practitioner should carefully avoid, and in regard to which midwives should be specially instructed and cautioned.

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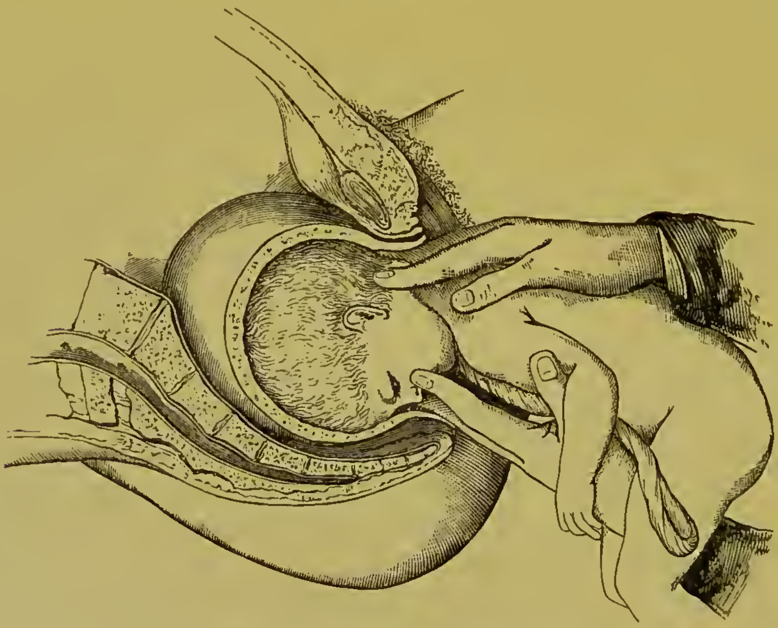
[1] It is proper to observe, however, that the forceps has frequently been used by Professor Hueter of Marburg and others. More recently, Professor Miles of Cincinnati has invented a special forceps for breech cases, which he seems to have found satisfactory.

The posture of the hands, and even of the arms, by the side of the head is an occurrence which, quite independently of unskilful interference, may spontaneously take place. Under all circumstances, it is an unfortunate complication, and requires, when recognised, immediate attention. So soon, therefore, as the lower half of the trunk has been born, and the cord has been looked to, we pass up the finger to ascertain the relative position of the arms. Should these be in the posture of which we have just spoken as the natural one, no interference whatever is required, but if they are applied to the sides of the head, it will be proper to bring them down singly. Selecting that one which is most within reach, a finger is to be hooked over the humerus, close to the elbow joint, when the arm is to be gently drawn forwards, so as to cause the forearm to sweep over the anterior surface of the child. If dragged down roughly, and without any reference to direction, fracture of the humerus may occur, as has indeed often taken place in the hands of the ignorant or unskilful. The one arm being released, the head will probably descend a little further, and the other, coming thus more within reach, is to be treated in the same manner. We must be careful, during the passage of the shoulders, that the perineum is neither distended in such a manner, nor in such a direction, as to endanger its integrity. The head, after the birth of the shoulders, now occupies the cavity of the pelvis, and the face, in almost all cases, will be found to have rotated into the hollow of the sacrum.

Birth of the Head.—This is the stage of greatest danger, and that at which the life of the child is most frequently lost. Consequently, it is the period which requires the most constant attention, and at which assistance has generally to be afforded. The powers of nature are, in a certain proportion of cases, sufficient to complete the delivery, so that even here there exists no necessity for operative interference as a point of routine duty. We must still, therefore, be guided by the circumstances of the case, and no single sign affords us more reliable information, as to the urgency of the symptoms, than the funic pulsation. The cord, however, now becomes exposed to more powerful pressure, and, at the same time, the function of the placenta is seriously interfered with, if not wholly arrested. The absence, in breech cases, of the not inconsiderable quantity of liquor amnii which remains in ordinary presentations till the last, allows of the firm compression of the placenta between the head of the child and the uterine walls; and, even should this not take place the great contraction of the uterine vessels permits of but a scanty supply of maternal blood for the oxygenation of that of the fœtus. This, then, may truly be called a critical moment, in which, although placental respiration has all but ceased, aerial respiration is as yet impossible. A life trembles in the balance, and a few minutes at furthest will decide its fate. Impending death from asphyxia is indicated in such cases, not only by a failure in the circulation of the cord, but by failure of the heart's action, and by convulsive movements of the respiratory muscles and of the limbs. Such spasmodic attempts to fill the lungs with air are of the nature of reflex actions, excited probably by the contact of carbonated blood with the nervous centres. They indicate, therefore, impending suffocation, and call for immediate action. It is assumed, of course, that before matters have gone so far as this, we have in readiness such appliances as may be required, hot and cold water, and the forceps —everything in fact which may be requisite, whether for the delivery of the child, or for its restoration, should it be born, as frequently occurs, in a state of suspended animation.

When the signs just mentioned indicate that the moment for operation has arrived, we must act without a moment's delay, a few seconds making all the difference between success and failure, life and death. The body and shoulders must not be grasped and pulled directly downwards, as is sometimes done. To do so would probably defeat our object, by pulling down the occiput towards the pubic arch, instead of favouring the natural movement of flexion; and, besides, forcible traction of the neck is by no means free from the risk of causing instant death by injury to the spinal marrow. The following simple manœuvre answers admirably in ordinary cases, and will rarely fail to release the head. The body of the child rolled in a napkin is laid along the right forearm, which is then carried upwards between the thighs of the mother, so as to bring the back of the child quite towards her abdomen. Very gentle traction is all that is necessary to combine with this movement, in order to permit the extraction of the head, which is mainly effected, indeed, by the flexion of the neck which is thus encouraged. Should this fail, the same movement may be combined with extractive force, applied directly to the head by one or two fingers in the child's mouth, or what is better and safer, two fingers applied to the superior maxilla, one on either side of the nose. Some of the best authorities recommend a simple method by which all traction on the neck is avoided. In this, which is represented in Fig. 136, two fingers of the left hand are introduced, as above described, while the occiput is pushed upwards behind the symphysis by the corresponding fingers of the right hand: the movement of flexion essential to delivery is in this way effected, while the face and forehead are drawn forwards along the distended perineum. By such a proceeding, some have succeeded in establishing respiration, even before the head was born, and with this object in view, Dr. Bigelow has recommended the use of a flat flexible tube, which is to be passed within the vagina into the mouth

Fig. 136.



Delivery of the Head in Breech Cases.

of the child. All these manœuvres must be varied, in cases of occipito-posterior and other exceptional positions, in accordance with the natural mechanism of each case.

If, however, the resistance is unusually great, we must, in preference to dragging upon the neck, apply the forceps without delay to the sides of the child's head, and thus complete the delivery. If the child does not at once breathe, the usual means described under suspended animation must be adopted and persevered in, so long as the slightest chance remains of preserving the life of the infant. Any exceptional circumstances which may constitute impediments to delivery must be managed on general principles; and, in extreme cases, it may even be necessary to perforate behind the ear, and allow the contents of the cranium to escape. Should the child be dead, many of the precautions above detailed will of course be unnecessary.

CHAPTER XX.

TRANSVERSE PRESENTATIONS: COMPLICATED PRESENTATIONS.

TRANSVERSE PRESENTATIONS:—*The Arm or Shoulder the Presenting Part.—Causes of.—Signs of, before and during Labour.—Premature Rupture of the Membranes to be avoided.—Dorso-Anterior and Dorso-Posterior Positions.—Determination of Exact Position by Observation of the Hand.—Probable Course of an Unaided Case.—Occurrence of Spontaneous Evolution.—Spontaneous Expulsion.—Methods of Operative Assistance: Period of Labour to be selected: Cephalic Version: Podalic Version: Bi-polar Method.—Special Difficulties.—Procedure Modified if Child Dead.—Compound or Complex Presentations: Hand and Head: Hand and Foot, &c.—General Management of these.*

IN the Cross Birth of Hippocrates, the axis or long diameter of the fœtal oval is thrown across the womb—the most unfavourable position which could by any possibility be selected. There is scarcely a point on the surface of the trunk of the body in regard to which we may say that its presentation at the os uteri is impossible, and it is not to be wondered at, therefore, that some writers have described an infinite variety of Transverse Presentations. Experience has, however, shown that, whatever may be the case with a premature or putrid fœtus, a mature and living child, which has unfortunately its long axis across the womb, becomes generally a presentation of the arm and shoulder from the first. And, moreover, in the exceptional instances in which some portion of the dorsal, thoracic, or abdominal surfaces presents, it has been found that they are usually converted into shoulder or arm presentations by the descent sooner or later of these parts. For those reasons, and for this additional one—that the mechanism in all transverse cases is essentially the same—cases of cross birth may be considered solely as arm or shoulder presentations; and, when these have been fully described, it will be found that little remains to be specified in regard to the other possible presentations of the trunk. In one sense the presentation is not strictly a transverse one, as the breech remains on a higher level in the uterus than the head. According to the elaborate statistics of Dr. Churchill, the transvere presentation is met with once in about 230 cases.

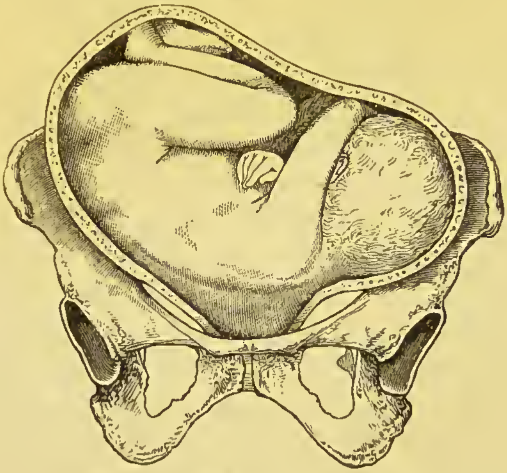
Causes.—The causes of transverse presentation are, although obscure, probably somewhat less so than in the case of the breech. Any fault or deformity in the structure of the pelvic brim, which may act by preventing the descent of the head into the cavity, may turn aside towards the iliac fossa that extremity of the fœtal ovoid, when the shoulder slips down and takes its place. In like manner, an unusual quantity of liquor amnii may, by destroying the ovoid form of the uterus, indirectly encourage the displacement in question; while uterine obliquity, and premature expulsion of the fœtus are also possible causes. The unfortunate tendency to a recurrence of this presentation, in women who have already had a child or children presenting by the superior extremity, would almost seem to indicate that some anatomical peculiarity of the parts may be the cause; and it was this which led Wigand to suppose that the form of the uterine cavity was the determining cause, and that, in those cases in which cross birth occurred, the transverse diameter of the uterus was in the first instance augmented, the long diameter of the cavity being thus relatively diminished.

Symptoms.—There are signs which, when distinct, may lead us, before the occurrence of labour, to suspect the existence of a transverse presentation; but, until the presenting part comes within reach of the finger, it is generally a matter of considerable difficulty to form a confident opinion. The increased attention which has of late—more particularly in the German Schools—been given to the study of abdominal palpation promises, however, to add precision to our diagnosis in this and other similar conditions where the pregnancy is sufficiently advanced and the abdominal walls are not unusually thick. In most cases, the belly of the woman is peculiar in shape, and elongated in a transverse direction, while, if the abdominal walls are lax and thin, we may recognise a tumour in each iliac fossa, one of which, situated somewhat lower, is more resistant and spheroidal, and the continuity between which may be established on palpation. It is sometimes possible to distinguish the hand, elbow, or shoulder, through the anterior wall of the uterus, from the vagina; but, generally speaking, when we discover the presenting part in this situation, the most we can say is that we feel a part which resembles the shoulder. Such an observation, however, associated with careful abdominal palpation, may point to a quite definite conclusion. The stethoscope gives us no reliable information, but there are cases, as Cazeaux observes, in which our diagnosis receives confirmation from this source. "If," he says, "the vaginal examination has resulted in the recognition of a portion of the fœtus which is of small bulk, and if we perceive the pulsations of the heart in the hypogastric region, we may almost certainly conclude that it is the superior extremity. If we heard the heart at the level of the umbilicus, it would in all probability be a leg." It happens, even more frequently in transverse than in breech presentations, that it is impossible to reach any portion of the fœtus with the finger alone in the earlier stages of labour; but, in most of these, the nature of the case will be recognised by introducing a portion of the hand. A marked effect of the height at which the fœtus stands is slow and comparatively painless dilatation of the os, and when the bag of water forms, it is, as in the case of the breech, very different in shape from that which precedes the head. In transverse presentations, the shoulder is the part which usually offers itself at the os uteri; but, as a considerable period often elapses before it comes within easy reach of the finger, it is often not recognised until labour has made some progress—a fact which bears in an unfortunate manner, as we shall see, upon the ultimate issue of the case.

It is, indeed, of the very highest importance that, if we have to deal with a cross birth, we should recognise the presentation as soon as it is possible to do so; and, when we have discovered a shoulder, an arm, or a hand, we should not rest satisfied until we have exactly, and to our perfect satisfaction, ascertained the position of the child. The prominence of the shoulder may be confounded with that of the tuber ischii, but may readily be distinguished by the absence of a similar tuber, at a little distance, with the genital organs between; and, should this negative evidence not be deemed sufficient, the finger passed towards the axilla, so as to feel the ribs, will remove, if they can be reached, such doubts as may remain. Care must be taken, in such manipulation as may be necessary, to avoid rupturing the membranes, for, so long as the child is not forced down upon the brim, and these remain intact, they are probably fulfilling their normal function of dilating the os, a process which should not, if possible, be interfered with. But, should the membranes be ruptured, or the shoulder be forced downwards, after rupture, into the cavity of the pelvis, and if we are still in doubt, it will be proper cautiously to pull down the arm and hand, which enables us not only to make sure of the presentation, but to recognise the particular position by a simple method to be hereafter described. There is no evidence that this procedure has any bad effect upon the progress of the case or otherwise, and the unanimous opinion of the most experienced accoucheurs is that, if carefully done, it is quite free from risk. But, even if a certain amount of risk necessarily attached to the operation, we should be perfectly justified in incurring it, in preference to attempting the management of the case without certain knowledge as to the position of the child. Some difficulty might occur in distinguishing the parts if not within easy reach. The manner in which the hand is recognised under such circumstances has already been referred to in the preceding chapter; but if, as will generally be observed, the arm hangs down into the vagina, there can be no difficulty whatever in distinguishing it from the lower extremity even by the inexperienced. The anatomical characters of the knee and elbow would enable us to distinguish also between these parts in the unlikely event of such a difficulty arising.

We have alluded to the care which should be exercised in manipulating, so as to avoid premature rupture of the membranes. There is, however, one advantage in this precautionary measure to which we have not alluded: this is the possibility of rectification of a transverse presentation. This has been observed by competent persons too often as a spontaneous occurrence, to admit of doubt as to its being an exceptionally fortunate issue of the difficulties of such a case; but it must be manifest that no such alteration in the axis of the child can occur when the waters have drained away, and it is grasped firmly by the uterus and forced in part into the cavity of the true pelvis. And not only this, but we know by experience that the change may, in favourable circumstances, be effected by a method to be afterwards described as that of Dr. Braxton Hicks, or, if the os is inaccessible by the finger, even more simply by external manipulation alone, after the method of Wigand.

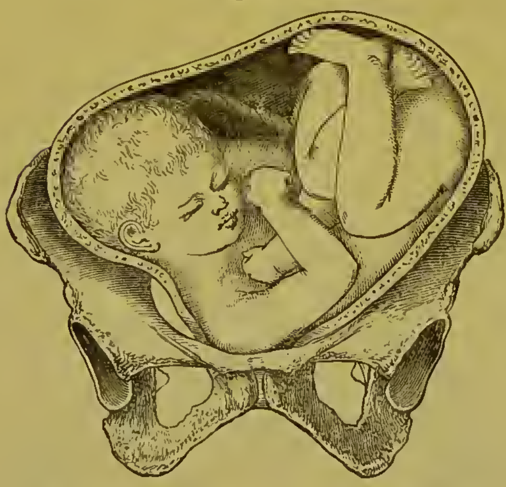
Fig. 137.



Transverse Presentation.—Dorso-Anterior.

Dorso-Anterior and Dorso-Posterior Positions.—If we except certain complicated and unusual cases, we may refer all transverse presentations to these two varieties, of which the former is more frequent in the proportion of two to one. In Dorso-Anterior positions (Fig. 137) the back of the child is, as in the corresponding positions of the pelvic extremity, turned forwards. But, as the head may lie either to the right or to the left, there are thus two varieties of this position, in one of which, the head being to the left side of the mother, the right shoulder presents; while, in the other, the head is to the right, and consequently the left shoulder is the presenting part. These varieties are to be considered without any reference to the pelvic diameters. Nor, if we consider that they are preternatural as regards the uterine diameters, can we even admit that they bear any such possible or practical relation to these, as would warrant us in placing them in the same category as the presentations of the ends of the fœtal ovoid which we have hitherto been considering. There is here no question—primarily at least—of oblique, transverse, or conjugate diameter, so that a separate description of the two varieties of dorso-anterior position is quite unnecessary. The same remark applies to the Dorso-Posterior position (Fig. 138), which in like manner offers itself for consideration under two varieties. In one, the head is to the right, and the right shoulder presents; in the other, the head is to the left, and the left shoulder presents. As regards the two principal positions mentioned, as well as their varieties, it is unnecessary to enter upon any elaborate description, as the management is in all cases essentially the same. The nature of the operative procedure which, in the great majority of instances, is necessary in the treatment of transverse presentations, renders it important that we should begin by ascertaining the exact position of the fœtus. Indeed, should we make a mistake in this particular, we know of a certainty that our error adds to the maternal risk, which is already considerable. Of great importance, therefore, is it that we possess the power of discrimination between the four positions which have been alluded to.

Fig. 138.



Transverse Presentation.—Dorso-Posterior.

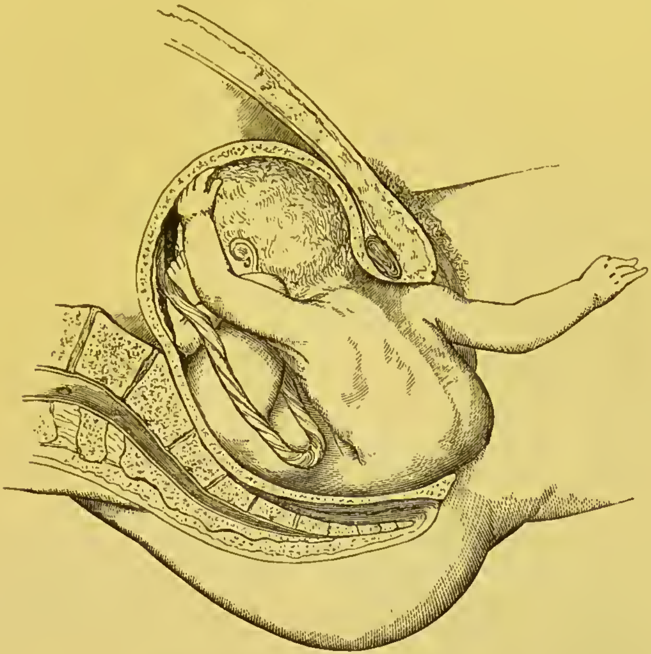
Diagnosis of Positions.—The points which we wish to ascertain, are:—to which surface of the womb, anterior or posterior, is the back of the child turned? and, to which side, right or left, is the head directed? To ascertain this by passing the hand within and around the womb would of itself be a serious operation; but we have fortunately a safe and certain means by which, under all ordinary conditions, we may at once determine the exact relation which the child bears to the uterine walls, and so modify our operative manipulations accordingly. The information in question is to be derived from a careful examination of the arm which presents. Prior, therefore, to any operation which we may find it necessary to perform, with a view to the rectification of this faulty presentation, we must pull down the arm and carefully observe it, unless, indeed, our examination of the presenting shoulder, and the parts beyond, should have sufficed clearly to establish the position of the child. The point to be first ascertained is, as to the presenting arm, whether it be right or left. This is determined, in the simplest possible way, by the accoucheur placing the palm of his hand against the palm of the child's hand—his finger tips pointing upwards towards its forearm—when, *if the thumbs correspond, so do the hands.* For example, if he employs, as most people do, the right hand, and finds the thumb of the child correspond to his little finger, he knows that it is the left hand, while if he finds them thumb to thumb, it is the right. This is a certain guide and one in reference to which there is no possibility of fallacy, but the information which is thus afforded is but limited, and only indicates that we have to deal with one of two possible positions. A more careful examination of the hand gives us complete and certain information, so that we know exactly where to find the anterior and posterior surfaces, and the head and feet of the child. The following rule is all that is necessary to remember :—*The hand of the child being supine, the Palm corresponds to the abdominal surface and the Thumb points to the Head.* Here, however, there is a possible source of error, which, if not avoided, will inevitably lead to wrong conclusions. For a moment's consideration will suffice to show that, if we omit to make sure that the hand is supine, we run the risk of its being pronated, which, by turning the palm towards the back, and the thumb towards the feet, may lead us to form an opinion which is, in every respect, wrong. Before making the observation, therefore, be sure that the hand is supinated—when error becomes impossible.

When the body of the child presents transversely at the brim of the pelvis, the labour almost invariably requires at the hands of the accoucheur the assistance of art. Indeed, it may be said that, if the pelvis be normal, and the fœtus living, mature, and of average size, it is scarcely possible for the woman to be relieved by the unaided efforts of nature. The progress and termination of such a case would probably be as follows :—After a tedious first stage, in which the dilatation of the os is unsatisfactorily effected, the membranes rupture, and the arm descends into the pelvis, either primarily, or, when the shoulder originally presents, after the labour has made some further advance. When this occurs, the pains become much more severe and strong; and with each succeeding effort the shoulder is forced down, and wedged into the cavity of the pelvis. The head being situated, however, to one side, and the breech to the other, progress beyond a certain point is manifestly impossible, so that when the utmost degree of moulding is attained of which those parts are susceptible, and the base of the wedge has entered the pelvis as far as the mechanical conditions will permit, no amount of uterine or other propulsive effort can produce the slightest effect. Left to nature, and attended with powerful uterine action, such a case must ere long involve the life of the child, not less by the great and continuous pressure on the neck and other vital parts, than by the implication, from the same cause, of the placental circulation. The actual degree of the pressure is further shown by the tumefaction of the limb which hangs down into the vagina, or protrudes partially from the ostium vaginæ. The sufferings of the mother are in no way alleviated by the death of the child, but, on the contrary, every minute of such fruitless effort renders her position more and more precarious. The continued pressure on the soft parts of the parturient canal may destroy in this way the vitality of the portions most exposed to its influence, when sloughing, more or less extensive, will occur, from the effects of which, coupled with the prostration and exhaustion which gradually wear out her powers of constitutional endurance, her sufferings are terminated by death. Or, at any stage of the labour, rupture of the uterus may occur, and a similar result will, almost inevitably, ensue.

Spontaneous Evolution.—Under certain circumstances, however, nature may relieve herself by a spontaneous process of delivery. This process is associated with the name of Denman, who discovered that, in some fortunate instances, nature afforded relief by what might otherwise be described as a process of spontaneous version. He found that, in those cases, the shoulder, or point of the wedge, did not maintain its position in the pelvis, but moved upwards, during the continuance of the pains, towards the brim of the pelvis, on that side which the head originally occupied, the head itself moving in a corresponding direction in the iliac fossa. This ultimately made way for the nates, which descended towards the floor of the pelvis, when labour terminated as if the case had been from the first a presentation of the breech. This observation of Denman's was hotly controverted by some of the most eminent obstetricians of the day, with the ultimate result, however, of establishing the correctness of his views.

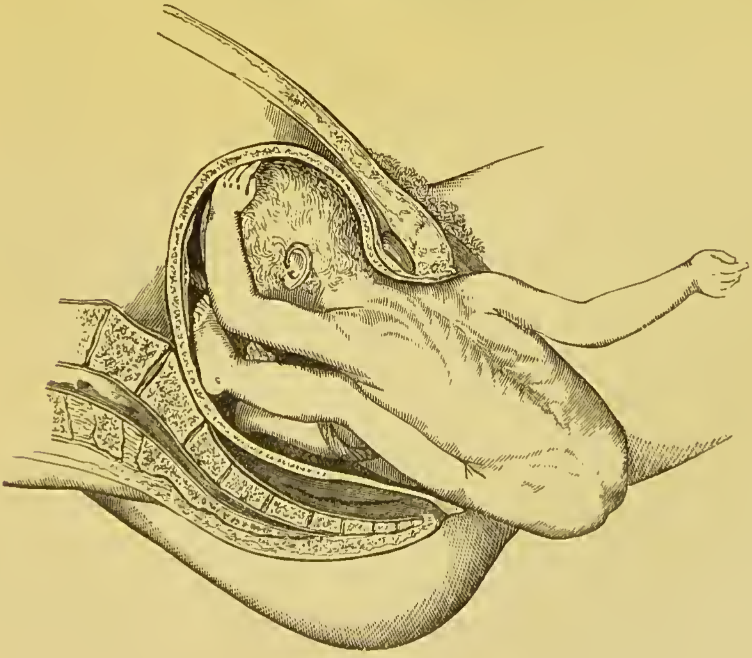
Spontaneous Expulsion.—The controversy, moreover, by directing general attention to the phenomena of spontaneous delivery, resulted in a thorough elucidation of the whole subject, from which it transpired that there was another process, and one of more frequent occurrence, according to which a similar result ensues. The credit of first describing this is generally attributed to Dr. Douglas of Dublin, who, to distinguish it from the process of Denman, called it

Fig. 139.



Spontaneous Expulsion. First Stage.

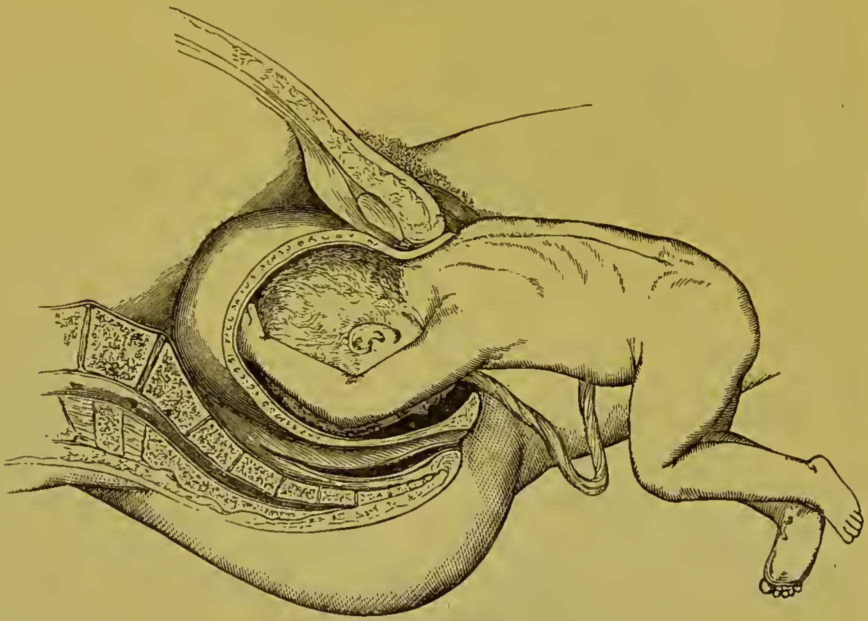
Fig. 140.



Second Stage.

Spontaneous Expulsion. The mechanism of this differs essentially from the former, as the shoulder, instead of ascending, continues to descend, until it becomes fixed against the sub-pubic arch, when it is arrested and forms a centre, upon which the whole body of the child revolves. It is obvious that such a mechanism as this can only be possible under exceptional conditions, such as a putrid or immature fœtus, or a pelvis of unusual size. For, in this case, the breech must pass the pelvic brim, which is already partly occupied with the base of the skull, an occurrence which is manifestly impossible if the relative proportion of the parts, maternal and fœtal, are in accordance with the normal standard. The mode in which the successive stages of the expulsion actually occur is shown in the accompanying figures, in which is depicted the manner in which, while the child revolves, the thorax, buttocks, and remaining shoulder succeed each other in their passage over the distended perineum. All being thus born but the head, the delivery of that part may either be effected by the natural efforts, or with the assistance of the accoucheur, in the manner already fully described in the last chapter. The long continued ineffectual efforts of the uterus, resulting in complete atony of its muscular structure, may at this stage cause the death of the woman by hæmorrhage so profuse that all our efforts are powerless to arrest it, an unhappy result which is more likely to occur in those cases in which operative assistance has been too long delayed.

Fig. 141.



Third Stage.

Treatment.—There are, perhaps, no cases occurring in the practice of midwifery which call for more tact, judgment, and operative skill, than those which are now under consideration. The object of all operative interference is the rectification of a preternatural presentation, so as to place the axis of the child in correspondence with the axis of the uterus, and thus permit of delivery in consonance with the mechanical laws which govern the normal process. Deliberately to leave the case to nature, on the chance of the occurrence of spontaneous evolution or expulsion, would be irrational in the extreme. For, although the risk of operative procedure must not be under-estimated, we may be quite certain that the danger which will accrue from delay is vastly greater, inasmuch as the child's life is sacrificed and that of the mother is placed in imminent peril. It is scarcely possible in these days that, in this or any other civilized country, a woman would be suffered to die undelivered, for sooner or later assistance would be sure to reach her. Such assistance, however, there is too good reason to believe, may be afforded at a period when the vital powers have already begun to flag, when the arm and shoulder are already wedged down in the pelvis, and when the life of the child has long been destroyed. All these circumstances increase very greatly the gravity of the case, and may often lead us to despair as to its ultimate issue; but, whatever the difficulties may be, the educated accoucheur must be prepared to cope with them, and to act in every case, even the most desperate, in such a manner as may at least give the mother what chance human skill can afford her. No one point, therefore, is of such importance as this—that we should recognise the position at the earliest possible moment. If we have the good fortune to do so early in the labour, we may look upon the case with calm self-reliance, knowing that the issue lies in a great measure in our hands. No pressure having at this time compromised the life of the infant, we hear its heart beating vigorously, and we may possibly feel it move, while the maternal parts have as yet been subjected to no mechanical violence. No details are requisite to prove that, in the two classes of cases referred to, the prospect of success is very different, and we therefore repeat that nothing, in point of importance, is to be compared with an early recognition of the case. This enables us, moreover, to select the time at which we may act with the greatest probability of success.

Operative Interference.—The choice thus afforded us must be taken advantage of with discrimination, and in full view of the facts which have been detailed. The responsibility which devolves upon the accoucheur in such a case, renders it essential that his services should be available on any emergency, such as the arrival, somewhat earlier than he might perhaps have been prepared to expect, of the moment favourable for operation. For, as will presently be made apparent, this period may be of short duration and, if it be not taken advantage of, the case may pass very rapidly into another category, in which the risk to mother and child is greatly increased. It is of the first importance, as has already been mentioned, that the integrity of the membranes should be preserved as long as is possible. Any clumsiness or violence of manipulation during the course of an ordinary vaginal examination, may thus, by causing the escape of the waters, not only permit of the descent of the abnormal presentation, but may, by complete evacuation of the liquor amnii—upon the same principle as in pelvic presentations—bring the uterine walls into immediate contact with the surface of the child. This is all the more likely to occur if we examine during a pain, so that we should carefully avoid examination at this moment, or at least conduct it with special caution. The patient is to be confined strictly to the horizontal posture, but so long as the child is alive, the os but partially dilated, and the presenting part still high, it is better to wait than to attempt a forcible dilatation of the os, which would most likely involve a rupture of the membranes. This is the period, however, at which an attempt at rectification may be made with considerable prospect of success, if we combine the use of the finger internally with the external manipulation of Wigand, according to the method first suggested by Dr. M. B. Wright of Cincinnati. After having ascertained the exact position of the child, or at least the side to which the head is turned, this may be effected by pressing the shoulder upwards from the vagina, while the head is pressed down towards the brim of the pelvis and, if necessary, retained there by the other hand, which is applied to the surface of the abdomen. The process effected by this manœuvre is what is termed Cephalic Version. The same result has been successfully attained by Hamilton, Gooch, and others, by manipulation which is purely internal, and by Wigand and Martin, by a method in which the manipulation is exclusively external, but it is to Wright, and more particularly to Braxton Hicks, that we owe a full exposition of the combined method.[1]

Turning.—The treatment almost invariably adopted in transverse presentations, is the operation known as Turning or Podalic Version, to be afterwards more particularly described. Should this operation be determined upon from the first, the integrity of the membranes is of even greater importance than before, and the state of matters which is most favourable to its successful performance is to be found when the os is in such a condition, as regards dilatation or dilatability, as to permit the passage of the hand, should that be necessary, while, as yet, the liquor amnii has not escaped. Waiting patiently till full dilatation has been attained, or till rupture of the membranes takes place, increases in no way, as we have seen, the risks of the case. But, so soon as either event occurs, we at once proceed to the operation by introducing the hand, seizing a foot, and bringing it towards the os uteri, whence the shoulders will recede—under such circumstances at least—without difficulty. The mode previously detailed of ascertaining the position of the child by observation of its hand must here be practised if necessary, as the result of an error in this respect, or a hap-hazard introduction of the hand within the womb, will greatly increase the risk to the mother which attends the operation, even when most skilfully performed. The position of the child being ascertained, the palm of the child's hand will indicate the abdominal surface, to which the hand of the operator should always be directed, while by pushing the hand in the contrary direction to that in which the thumb points, the feet will most easily be reached, and at a minimum of risk. The method of combined version is equally applicable for podalic as for cephalic version. And it requires no argument to show that, if it be practicable thus to effect the object in view, an operation which consists in the introduction of one, or at most two fingers into the uterine cavity, must involve less risk than necessarily attends the ordinary procedure of turning by the feet. That it is practicable, we have had several opportunities of demonstrating, and it is without any hesitation, therefore, that we recommend that this method should in the first instance be tried in every case, and the more severe operation only in those instances in which the former fails. As in its application to cephalic version, it is better to attempt rectification so soon as the os has sufficiently dilated to admit the finger, and to permit an accurate diagnosis. With the escape of the waters, the mobility of the fœtus is, for obvious reasons, diminished.

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[1] See Dr. Braxton Hicks' Memoir "On Combined External and Internal Version." London, 1864.

The following, from Dr. Hicks' published cases, is a striking instance of how, even under most unfavourable circumstances, combined version may be practised with perfect success.

"Mrs. M——, admitted into Mary Ward in April, 1861. The antero-posterior diameter of pelvic brim measured only two inches and one eighth, which had caused her labour to be accomplished with the greatest difficulty; embryotomy being employed on the last occasion, although brought on at the seventh month. Labour was induced on 13th April last, in the seventh month of this her fourth pregnancy, by puncturing the membranes. Pains came on in about sixty hours, after which they continued to increase for twenty-four hours, at intervals of five minutes. The os uteri was then about the size of half-a-crown, still unyielding, scarcely admitting two fingers. The liquor amnii still existed in small quantities, draining slowly away. The shoulder presented, the head being to the right side, the breech to the left, but both approaching the fundus, the child being somewhat doubled on itself. As it was of much importance to rectify the presentation before the os dilated, so that the presenting part might not be driven lower down; and as the footling presentation seemed, with so narrow a brim, and a small soft head, to give the best chance for the life of the fœtus, I decided on attempting podalic version. The patient was put under the influence of chloroform. The left hand was introduced into the vagina, with two fingers through the os, and the presenting part pushed in the direction of the head, while the right hand pressed down the breech from without. The fœtus did not glide round in the uterus very easily, for it was tightly clamped by it, and every movement within or without produced uterine action, consequently it required a little patience: but by varying the position and direction of the outside pressure, the foot was at last drawn into the os by two fingers. The chloroform was discontinued, and after about half-an-hour, slight expulsive pains appearing, gentle traction was made upon the child. It was not long before the os dilated and the child was brought down during the pains. Some detention of the head took place at the brim, in consequence of the very narrow antero-posterior diameter, and the child's life was lost. The mother did very well."

Special Difficulties.—The really difficult cases, and those in regard to which apprehension will naturally arise, are those in which we have to act after the shoulder has descended in the pelvis, and when the body of the child is tightly embraced by the womb. No attempt should be made under any circumstances to replace the hand and arm, should these have prolapsed; and it will generally be proper, before proceeding to operate, to allay the excited irritability of the uterus, which shows a spasmodic tendency to contract under the slightest stimulus. Of various means at our command, that which is most suitable for this purpose is anæsthesia, and if the patient be well brought under its influence, it is wonderful to what extent we succeed, in some instances, in relaxing the parts, so as to admit of the easy passage of the hand. In every case, however, such an operation is attended, as compared with one performed at an earlier stage of the labour, with greatly increased risk, the danger being in direct proportion to the amount of resistance encountered in an attempt to pass the hand. The condition of the bladder and rectum should, as a matter of course, be ascertained, and, if necessary, those viscera emptied before any attempt is made at rectification. A peculiar and special resistance may proceed from the state of the os, which, if rigid, may constitute a barrier to the passage of the hand. In this case, if the waters have escaped, and the probability of its dilatation within a given time is thus a matter of great uncertainty, we must endeavour to dilate the os, either by the finger in a manner which will be afterwards described, or by means of some such mechanical appliance as Barnes' bags, and then proceed in the usual way. We may be summoned to cases in which, although the wedging of the shoulder is complete, clear evidence is afforded us of the death of the child. The proof of death may consist in the signs of actual putrefaction, when the skin will peel off the presenting part, in the observation of a flaccid and pulseless funis—which is not unfrequently prolapsed in these cases—and in the absence of fœtal pulsation and movement; of which signs the first two may be regarded as certain, while the last is to be accepted with caution. Our procedure here is to be modified by the fact that we have now no longer the interest of the child, but that of the mother alone to look to, so that our object simply is to deliver her in such a manner as may subject her to the smallest possible risk. If, therefore, in this case, there is any special difficulty in turning, we should at once reduce the bulk of the child by evisceration, or bisect its long axis by decapitation, and then proceed to extract it in the manner which may seem safest and best.

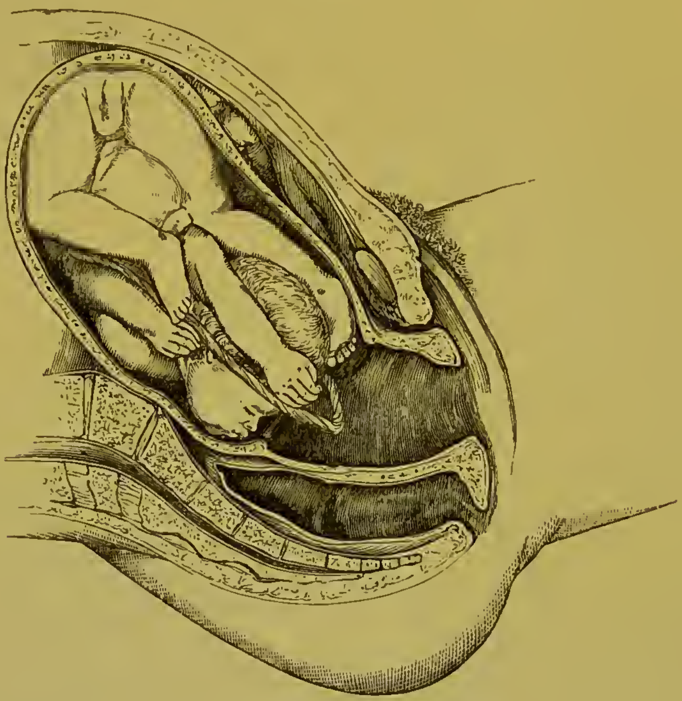
In a very few cases, in which the special circumstances favourable to such an occurrence are present, it may be obvious that the case is about to terminate spontaneously, according to the methods of Douglas or Denman. This will be recognised in each case by careful examination —more especially during the pains—which will enable us to make out that the process of revolution is being gradually effected. Delay is, under such circumstances, quite proper, more particularly when the child is dead. With reference to spontaneous expulsion, Dr. Douglas says, "If the arm of the fœtus should be almost entirely protruded, with the shoulder pressing on the perineum; if a considerable portion of its thorax be in the hollow of the sacrum, with the axilla low in the pelvis; if, with this disposition, the uterine efforts be still powerful, and if the thorax be forced sensibly lower during the pressure of each successive pain, the evolution may, with great confidence, be expected."

Compound or Complex Presentations.—In addition to the various presentations already described, there are many others, of rare, though possible occurrence, in which certain parts, anatomically distant from each other, come together towards the os uteri. Most of these presentations are varieties of transverse presentation; but in some, again, the coincidence of the long axis of the child with that of the uterus is maintained. We shall only mention here one or two of the many possible compound presentations. When the Hand and Head present together, the mechanism of natural delivery is, of course, complicated to the extent of the diameter of the arm. In a pelvis of large, or even of ordinary dimensions, there is nothing to prevent a satisfactory termination of the labour; but, if the pelvic diameters should chance to be ever so little out of proportion, the presence of the arm may make all the difference in the world, and suffice to jam a head which would probably have passed, under the ordinary conditions, with very little more difficulty than usual. Nay, even when a hand presents on either side of the head, there is nothing absolutely to prevent the birth of the child, which has, in fact, been observed to pass, under such circumstances, without any marked difficulty whatever; so that, in both of these instances, we have to deal with conditions very different to those which obtain in cross-births. But the chance of delay and protracted suffering is sufficient warrant for us, in such cases, to attempt a rectification of these presentations, if only this can be effected without incurring the risk of making matters worse. What we wish to do is to push the arm upwards, so as to allow the head to descend, and alone to occupy the cavity of the pelvis. In making such an attempt, however, we must be particularly careful not to displace the head; for, if the result of our interference were to be that the head was moved from the brim to the iliac fossa, and the shoulder thus permitted to descend, we would find that we had converted a comparatively favourable presentation into one of the most unfavourable which it is possible to conceive. For this reason, it is generally better to avoid all such attempts until the head has entered, or is becoming engaged in the pelvic brim. If we then use ordinary caution in our manipulation, we may attempt, without hesitation, to effect our object by pressing the prolapsed limb steadily upwards; and, along with this, we should try to retain the head against the brim, in such a manner as to prevent the slipping down of the arm, until the uterine efforts have caused the head to descend so far that this is no longer possible. This latter indication has been successfully fulfilled by combining external with internal manipulation, and that in a manner which would encourage us to repeat the manœuvre on any occasion which might occur.

The Feet and Hands, or one of each may present, and thus constitute what may be termed an unusual variety of transverse presentation. It is a common occurrence, in this variety, to find prolapse of the funis as a further complication, and one unfortunately which will add in no small degree to our perplexity. As we could scarcely expect in such a case to replace both limbs, and as prolapse of the cord of itself involves very serious danger to the life of the fœtus, the very obvious and proper procedure is to draw down the inferior extremity, and thus complete podalic version. For, if we leave it to nature to select by which of the poles of its long diameter the child will descend, it is more than probable that the shoulder will slip down, and the difficulties of the case will then be very greatly aggravated. Or, as is still more likely, the upper and lower limbs will together become wedged into the pelvis, and the progress of the labour be as effectually barred as in an ordinary transverse presentation. If the mobility of the fœtus within the womb is as yet not seriously interfered with, no great difficulty will be incurred in the operation, and, as the child revolves, its arm will leave the vagina and follow the head in its movement towards the fundus. But, if the child is so firmly grasped by the womb as to render the operation unusually difficult, the woman must be put under the influence of chloroform, and a fillet attached by a running noose above the ankle (see Chap. xxxi.), when steady traction upon this, combined with pushing up the arm, with the further aid of external manipulation afforded by an assistant, will usually effect the version. Should the cord have formed one of the elements of the original presentation, great attention must be paid to it, in order, if possible, that it should retreat into the uterine cavity along with the superior extremity; failing which, it should be guided into that part of the pelvis where it is least likely to be exposed to injurious pressure. The case, otherwise, is to be managed as an ordinary footling presentation, and delivery slowly or rapidly effected according to the urgency of the symptoms and the other attendant circumstances.

Presentations more complicated still may be, although rarely, encountered. We may have, for example, the Hand and Foot presenting along with the Head, or we may have, as in the case which is represented in the accompanying engraving, a presentation of the Forehead, Hand, Foot, and Cord. All such cases are to be managed on similar principles by the performance of podalic version. In the case here represented, the whole of the presenting parts were tightly jammed in the pelvis, the child firmly embraced by the uterus, and the cord flaccid and pulseless, before it was brought under our observation. The woman had previously borne several children at the full term. Although greatly exhausted by a fruitless labour of many hours' duration, her pulse was of tolerable strength, and it was resolved, after the administration of some stimulants, at once to proceed to the operation. Version was, however, in this instance, effected with extreme difficulty, in the manner above alluded to, by the hand and the fillet. When the child was born, it was found to assume, as if from imperfect cadaveric rigidity, the attitude which it had occupied within the womb. This was so characteristic that a cast was taken, of which the drawing is a tolerably correct representation. Other complex presentations, in addition to those enumerated, may, as we have said, be met with, but the above will suffice to indicate the general principles upon which their treatment is to be based.

Fig. 142.



Case of Complex Presentation.

All cases of transverse or complex presentations are attended with greatly increased risk as regards the child; and, even under the most favourable circumstances, with a considerable addition to the dangers which women undergo in childbed. In the former class, it has been found that, even including those cases in which the most skilful assistance has been afforded, more than a half of the children perish, while, as regards the mother, the deaths are about one in nine. The fatality in both depends, in a very great measure, as all experience has shown, upon the period or stage of the labour at which assistance is first afforded.

CHAPTER XXI.

FUNIS PRESENTATION.

"Presentation" and "Prolapse" of the Cord.—Relation of the Funis to other Presentations.—Causes of.—Symptoms of at Various Stages of Labour.—Great Danger to Child.—Treatment: at first Expectant: avoid rupture of the Membranes: Reposition by the Fingers; by Mechanical Appliances: Various Repositoria described: Postural Method: Use of the Forceps: Turning.

SOME writers have, without any obvious advantage, drawn a distinction between "Presentation" and "Prolapse" of the Umbilical Cord. By the former term is implied those cases only in which a portion of the cord is situated in the lowest part of the amnionic cavity, so that it may be felt from the vagina, either through the inferior portion of the uterine wall, or through the membranes, when the finger can be passed by the os. Prolapse, again, is restricted to cases in which, after the rupture of the membranes, a loop of the cord passes into the vagina, or even hangs from the vulva—in both cases preceding that portion of the child's body which presents at the os uteri. Such a distinction as this is, in so far as classification is concerned, obviously useless, seeing the Prolapse is merely a more advanced stage, and an almost inevitable sequence, of the Presentation.

At the beginning of labour, the funis may present alone at the os, and may be felt to occupy the bag of waters before the child has descended; or, what is more usual, it descends along with the cranium, nates, shoulder, or any other part of the fœtus, becoming prolapsed only when the membranes give way. Presentation of the cord is an occurrence which, although not very frequent, is so hazardous, as regards the life of the child, that we cannot pass it by without careful attention. Considerable discrepancy exists as to the frequency of its occurrence, and it has been variously stated by competent and experienced observers at from 1 in 37 to 1 in 382. There can be little doubt that it often occurs without its being recognised, in those cases chiefly in which the loop is small, and the prolapse consequently trifling. This may, in some measure, seem to account for the discrepancy alluded to; but we may confidently accept of the statistics carefully compiled by Dr. Churchill—which, on a total of 90,983, give one case of funis presentation in 282,—as indicating, approximately at least, the state of the case. It is in cranial presentations that prolapse of the cord most frequently occurs—a fact which depends wholly upon the great preponderance of these as compared with the other presentations. Considered, however, relatively to transverse, breech, and the rarer presentations, we find that it is most frequent with the shoulder, then with the breech, and, in point of fact, is more likely to occur in any other presentation (relatively to its actual frequency) than in cranial cases, where the ball-valve formed by the head is, as we shall show, less likely than any other part to admit of the descent of the coil. Scanzoni brings out the following as the result of his experience:—

Funis presenting once in 304 Cranial Cases.
,, ,, ,, 32 Face Cases.
,, ,, ,, 21 Presentations of Pelvic Extremity.
,, ,, ,, 12 Transverse Presentations.

Causes.—The causes of funis presentation vary according to the presentation of the child, and are also influenced by other circumstances. Among the predisposing causes, an unusual quantity of liquor amnii is a condition which, by separating the uterine walls from the surface of the fœtus, must certainly encourage the displacement in question; and it is mentioned by Scanzoni that, in more than a third of the cases observed by him, an unusual quantity of liquor amnii existed. Probably, the larger the quantity the more likely would be the descent of the cord, so that in cases of Dropsy of the Amnion we might anticipate the probability of such a displacement. In the case of a cord of unusual length, the conditions are also such as singularly to favour its gravitation downwards, either prior to the rupture of the membranes, or during the escape of the waters, when the loop suddenly slips down along with the gush of fluid. In cases where the placenta is inserted near the os, and the cord lies, consequently, in its immediate vicinity, the danger of prolapse must manifestly be increased, and will, on the contrary, be reduced, the further the site of the placenta is from the lower segment of the womb. It is doubtful whether a pelvis of unusually large size favours, as some have supposed, the descent of the cord; in fact, we are inclined to believe that so far from this being the case, the unusual depth in the pelvis of the presenting part, in these cases, is more likely to prevent the accident, by a firmer contact than usual with the inferior part of the uterine cavity. But it is otherwise with a narrow pelvis, and more especially in such instances as show marked contraction at the brim. In these, the descent of the presenting part, and the occupancy by it of the inferior part of the womb, are mechanically hindered, to such an extent that the cord is either forced down by the uterine contractions into the bag of waters, or, upon the escape of these, is carried past the arrested head by the impulse of the momentary torrent. Cases of this kind have been recorded by Mr. Roberton of Manchester, who paid particular attention to the subject.

There is, probably, nothing which acts more decidedly in producing this unfortunate situation of the cord than the nature of the presentation. The more thoroughly the lower region of the womb is occupied by the corresponding portion of the child, the less likely is prolapse to occur: and we find, therefore, that the less effectively this condition is maintained, there is, in direct proportion, increased danger to the cord. In the case of the cranial positions, a very superficial observation of the facts of the case will suffice to show how admirably adapted these are to the mechanical prevention of the displacement in question. It is true, indeed, that it is not the head which, in the first stage of labour, presses during a pain upon the os, and it might be assumed, as by no means improbable, that the cord should slip down into the interval between the membranes and the head. But a more close attention to the mechanism of a labour-pain—which has been fully described in a previous chapter—shows that nature apparently provides against such a movement on the part of the cord, by commencing the contraction in the cervix, from whence it passes upwards, and thus, by a sort of inverted peristaltic action, maintains the relative position of the parts, which is only likely to be disturbed under such peculiar circumstances as have been above detailed. So soon as rupture of the membranes permits of the immediate application of the head to the circumference of the os, the same action, beginning in the sphincter fibres of the cervix, and exercised equally upon the spheroidal cranium, still more effectually prevents displacement.

It is widely different in the other presentations of the child, which we may here consider together. In the case of the face, the conditions approach more closely to those of cranial presentations than to any other; and we thus find, as we might have anticipated, in the table quoted above from Scanzoni, that these are, next to the cranial positions, the most favourable. As regards presentation of the nates, we have here also a rounded mass, occupying the lower segment of the uterus, in a manner which in most cases is sufficient to maintain the position of the cord. That its descent occurs in a much larger relative proportion of cases than in cranial presentations, is to be accounted for by various circumstances. We cannot fail to observe, in the first place, that there is not the same regularity in the circumference of the presenting breech as in the case of the head. There are thus, necessarily, various points at which the contact between the uterus and the presenting mass is comparatively insufficient, so that the cord may easily glide down at those points where the resistance is least. We can easily conceive it possible that, in this manner, a loop of the cord may slip down over the genitals in the interval between the nates and pass into the vagina. Should the presentation be one of the knees or feet, the conditions favourable to a descent of the cord are even more exaggerated. It is in transverse presentations, however, that the cord most frequently descends along with, or in advance of, the presenting part. There is, in this case, but little to prevent the displacement in question, and neither the shoulder nor the arm can be looked upon as, in any sense, the mechanical equivalent of the cranium, but what makes matters worse, in breech and transverse presentations, is the proximity, in every case, of the umbilicus to the os uteri, which must still further multiply the conditions favourable to displacement. But, of all possible cases, those in which prolapse or presentation of the funis is most likely to occur are what have been described in the preceding chapter as complicated presentations—such as hand and head; hand and foot; head, hand, and foot; and the like—in which the conditions favouring prolapse reach their maximum.

Sudden rupture of the membranes, with the accompanying gush of waters, has been placed by some in the first rank as a determining cause of prolapse of the funis. This is claiming for the phenomenon in question too important a position. No one can deny that "prolapse" of the cord usually takes place at this moment, but the determining cause of the displacement has, probably in almost all these cases, been previously in operation, and has already induced a descent of the cord as far as, prior to the moment of rupture, is possible. It may, no doubt, happen that, under special circumstances, such as abundance of the liquor amnii, a loop of the cord may be carried down past the presenting part along with the fluid, but the usual occurrence, we apprehend, is that the prolapse at the moment of rupture is merely a more advanced and complete stage of previous displacement.

Symptoms.—The symptoms by which this accident is to be recognised vary according as the membranes are intact or ruptured. In the former case, the diagnosis is attended with considerable difficulty, inasmuch as we can only be guided by the sense of touch through the membranes or the thin uterine walls. It is quite possible, at this stage, to mistake the inequalities which are presented by the fingers and toes for the irregularities due to the twisting of the cord; and, in such cases, the only sign upon which we can confidently rely is the observation of the umbilical pulse. This is, however, not always easily made out, unless we are able to compress the cord between the finger and the presenting part of the child. And, even when we do feel pulsation, we must be cautious not to mistake it for that due to enlarged maternal vessels, which is to be distinguished by the synchronism of the latter with the radial pulse. It is then unequivocal fœtal pulsations only which are to be accepted under those circumstances as satisfactory evidence of the displacement which we are now considering. Whatever doubt may exist as to the nature of the case is at once dispelled by rupture of the membranes, when the loop of the cord escapes into the vagina, or may even pass so far down as to come into sight at the orifice of the vagina. But, should the coil be small, or any other circumstance prevent its prolapse, no difficulty will be met with in perfecting the diagnosis, as the cord may now be felt distinctly, rolling beneath the finger, and its pulsation may be ascertained by compressing it directly between the fingers. The fingers and toes, should these parts have given rise to doubt, may, by a similar method of examination, be readily distinguished. There is one possible source of error, against which the inexperienced observer must here be on his guard. It occasionally happens that, in extensive rupture of the uterus, a coil of the small intestine passes through the aperture into the uterus, and even into the vagina; and, although the presence of the mesentery and the absence of pulsation should in such cases obviate the possibility of mistake, the sensation which the bowel yields bears such a resemblance to the cord that an opinion might rashly be formed, which might lead, in practice, to the most disastrous results. Several cases, at least, have been recorded in which this blunder has been committed, with the most discreditable and unfortunate issue.

As regards the mother, there is no risk whatever in a presentation of the funis. Experience has, however, shown that, of all possible presentations, not even excepting transverse cases, nothing is more fatal to the life of the fœtus. Of all cases, and without any reference to the fact of assistance being rendered, it is certain that considerably more than one half of the children are lost, which is sufficient to show that the treatment or management of the cord in these cases, during labour, is necessarily one of the most important points which can possibly arise in the course of practice. What we desire to effect is the protection of the cord from such pressure as may arrest the circulation, or, in other words, to avert, if it be possible, from the child, the danger of death from asphyxia. We have already seen, in reference to presentations of the pelvic extremity, that the chief cause of increased mortality in these cases is pressure on the cord, and the same remark obviously applies with equal force to all cases of transverse or other presentation in which podalic version is practised. But, unless there should be prolapse, the danger is confined to the later stage of labour, during which the cord is subjected to pressure between the head and the pelvic walls. If the cord presents originally, the vessels are obviously subjected to a more prolonged and continuous pressure, so that the danger is considerably increased. When, in any case, the labour pains are frequent, violent, and of long duration, the chance of the child's life is small, unless delivery should be effected with unusual rapidity; but if, on the contrary, the pains are moderate, and of short duration, the fœtus has time to rally, during the intervals, from the effects of the partial asphyxia which attends each uterine effort, and the cumulative effect of pressure is in a measure avoided. We must, however, even under the most favourable circumstances, look with serious apprehension, as regards the interests of the child, upon all cases of funis presentation, and we would do well to make a point in all such instances of informing the friends of the patient of the precise danger which we anticipate. Many circumstances, other than those already mentioned, modify the danger of individual cases, but in all, the continuousness and the degree of the pressure are the points upon which the gravity of each particular instance depends. If it should so happen, therefore, that the cord occupies a position in which it is exposed to comparatively little pressure, the chance of the case is greater; and to this Naegele draws attention, and points out that, when the cord presents with the head in the ordinary or first cranial position, the life of the child is much more likely to be spared if the funis lies towards the left sacro-iliac synchondrosis, the point at which it is least likely to be subjected to injurious pressure.

Treatment.—Unless the circumstances are otherwise abnormal, so as to call for interference in the interests of the mother, we of course leave to nature all cases in which we have unequivocal evidence of death of the child. We must, however, be careful in admitting want of pulsation in the cord as satisfactory evidence of the death of the fœtus. If the cord be perfectly flaccid, and is examined continuously, during the occurrence of several successive pains, without any pulsation being discerned, we can have no doubt that all hope of the child must be abandoned. But, should the examination have been made hurriedly, during the occurrence of a pain, we may be led to abandon a remediable case while there is yet hope, as it has frequently been observed, in such cases, that pulsation is for a long period arrested during the pains, and returns in each succeeding interval. As a rule, then, we should examine during an interval as well as a pain; and it is only the continuous absence of pulsation which is to be admitted as evidence of death. In almost all other cases, it is proper for the accoucheur to afford some assistance; and in all, without exception, in which we presume that the child is alive, we must watch with constant attention the progress of the labour, so as to afford at the proper moment such aid as may be applicable to the exigencies of the case. The indications of treatment which are to be observed are, either the entire relief of the cord from pressure, or its removal to where it will be subjected to the minimum of compressing force. Whilst there are special cases in which little or no interference is required, or indeed justifiable, these form a very small proportion of the whole. The great majority, therefore, are those in which assistance of some kind or other is essential, and in many of them the skill and perseverance of the operator will be taxed to the utmost. The exact circumstances under which the displacement may occur, are of such infinite variety, that it were endless to attempt to lay down rules which may serve for the guidance of the operator in every case. There is, in point of fact, perhaps no contingency in the practice of midwifery in which sound judgment and self-reliance are so essential; but we are, nevertheless, enabled, in the light of the experience of the most distinguished accoucheurs, to lay down certain general principles, upon which the management of presentation and prolapse of the funis is to be based.

Should the cord be felt through membranes as yet unbroken, or through the uterine wall from the vagina, our treatment must be essentially expectant. It must not be imagined that integrity of the membranes is, under all circumstances, a guarantee that the cord is safe from injurious pressure, but so generally is this the case, that we are always bound to assume that upon nothing does the issue of the case so much depend as the prolonged retention of the waters. In cases, the termination of which is intrusted to the natural efforts, this is, indeed, of paramount importance; and, in all, we look upon the danger as imminent only, and not in actual operation, so long as the sac of the membranes prevents the prolapse of the cord. Nothing, therefore, can be more obvious than that we must exercise the greatest possible caution in such manipulations as we may deem necessary, with the view of subjecting the membranes to no such violence as might cause their rupture prematurely. In a word, the preservation of the membranes is, in all cases in which we may be fortunate enough to discover the cord before their rupture, a point of primary importance. For this reason, also, it is far better to leave the presentation in doubt than to run any risk of rupture of the sac in our anxiety to be correct in our diagnosis; and, on the same ground, it stands to reason that no attempt should be made to replace the cord at this particular stage, or even to guide it into those parts of the pelvis at which it will be exposed to least pressure. So long as the waters are retained, we may be confident that the cord is at least under more favourable conditions than could be afforded it by any remedial or operative procedure which we might think proper to adopt. In cases, therefore, in which the bag of the waters occupies the vagina after the termination of what is usually called the first stage, we do not act, as we would under ordinary circumstances, by rupturing the membranes, but, on the contrary, we look upon the exceptional persistence of the membranes as of good augury in regard to the child in all cases in which we have already recognised the funis. The longer, in fact, the liquor amnii is retained, the shorter will be the final stage during which pressure more or less severe must be encountered, and, other things being equal, the less proportionally will be the risk to the life of the child. Persistence of the bag of the waters up to the moment at which the head is being born is perhaps the case of all others in which nature is most likely to secure a happy result. Such cases, however—and along with them may be classed instances in which the capacity of the pelvis is greater than usual—are not frequently met with; but, when they do occur, we would be quite justified in simply watching the progress of the case, and only interfering when the symptoms become more threatening, or the conditions are such as to render prolonged compression of the cord a matter of certainty.

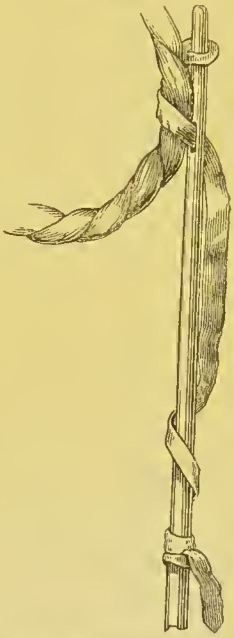
The cases which are of most usual occurrence in practice, and those, too, which are the most favourable in their results, are where the head and the cord present together. In cases in which this complicated presentation has been early recognised, when the membranes are complete and the os as yet but little dilated, it has occasionally been observed that the presenting cord has passed out of reach, and the head descends alone as in an ordinary case. The possibility of such a satisfactory result would of itself suffice to warrant us in endeavouring by every means to preserve the integrity of the membranes, but the result is not, as will be understood, one upon which we can, in any circumstances, depend. It has been asserted on good authority, however, that the conditions which render such an occurrence most likely are a small loop of cord, which is situated higher than usual and to one side of the os, and when the projecting bag of the membranes is embraced by the lower segment of the womb with unusual force. When the cord descends along with the head, the risk is not so great to the child as in other complicated presentations of which the cord forms an element; for, although the actual compression is greater, it is of much shorter duration than in breech and footling cases, and moreover, the danger may practically be said to be over so soon as the child's head is born. And, in addition to this, the possibility of successful reposition of the cord is much greater, on account of the more thorough adaptation of the spheroidal head to the cavity through which it has to pass. If, on the other hand, we have to deal with the pelvic extremity, the cord, when replaced, is more likely to prolapse anew, and in every such instance the chance of prolonged compression is much enhanced. No doubt the actual pressure is, in the first instance, less than when it descends along with the head, but we must in such a case look forward, not only to a longer continuance of pressure, but, in addition, to the same ultimate compression from the head, at a period when, from long continued interruption to the placental circulation, and by the operation of other causes, the life of the child is already in imminent danger.

When that stage is reached at which the dilatation of the os is what we call complete, the membranes being as yet unruptured, it may occasionally be a matter of some difficulty to determine upon what principle we are to proceed in the management of the case. We know that the danger is greater in first than in subsequent pregnancies, and in mature than in premature deliveries, but beyond this we have nothing, in addition to the facts already mentioned, which may guide us, further than a correct appreciation of general principles. If, upon examination, we find that the cord still pulsates, we may perhaps use a little more freedom with the finger, in order to ascertain the probable extent of the coil, and the exact nature of the presentation, but, with this exception, we must generally content ourselves by watching the progress of the case. As the head descends, we should try, if it be possible, to guide the cord towards the sacro-iliac synchondrosis which corresponds to the side of the cranium; and in pelvic presentations it will also be proper to act upon the same principle by directing it to that synchondrosis which may correspond to the antero-posterior measurement of the breech, with the view, in each case, of placing the cord at that point of the pelvic circumference at which the pressure will probably be least.

Reposition of the Cord.—With the rupture of the membranes, the cord will usually prolapse, to an extent proportionate to the size of the coil which precedes or accompanies the presenting part. This is the stage which we will generally select to attempt the Reposition of the cord. With this object in view, we bring the points of the index and middle fingers to bear upon the coil in the interval between the pains, and thus endeavour to push it upwards, beyond the presenting part, into the cavity of the uterus. The process, when the coil is large, will resemble somewhat the procedure applicable to the reduction of a large hernia, by successively replacing portions of the cord until the whole has been reduced, remembering always that, to be effectual, reduction must be complete, and that, if ever so small a portion be left down, pressure may be as fatal as if we had never attempted the operation. But, with the actual reposition of the cord, our difficulties do not cease. The reduction of the prolapse may be easy enough, but the real difficulty consists in maintaining it in its position. The finger must, on this account, not be hurriedly withdrawn; on the contrary, we should, by continuous support, endeavour to retain it within the cavity until the child descends somewhat further, and forms, by its presenting part, a plug, which renders impossible, from its bulk, the renewed descent of the funis. The finger should, with this object, be cautiously removed during a pain, when the conditions referred to are, of course, present in the highest possible degree, so that, if the operation is successful, the labour will now be completed without any further risk than attends an ordinary case. For the reasons already stated, success will more frequently attend our efforts when the head of the child presents, as this part more thoroughly fulfils the condition of an effective plug. Unfortunately, however, in a large proportion of cases this manœuvre will fail, and the cord will descend again and again, under the impulse of the uterine contractions. It was, probably, this unsatisfactory result which induced some noted authorities to recommend a more thorough method of reposition, by carrying the cord upwards towards the fundus of the womb, and endeavouring to suspend it over the limbs of the child, or at least to press it completely beyond the head, into the hollow formed by the neck. Both of these modes of procedure have been repeatedly resorted to, and sometimes with success; but the difficulties which attend the operation in each case are such that, in the greater number of instances, we will fail utterly in our endeavour to maintain the cord in its improved position.

This acknowledged and, in some instances, insuperable difficulty has given rise to much mechanical ingenuity. The object in view is to devise an instrument by means of which the funis may safely be returned to the upper part of the uterus, and, if necessary, retained there. Of such as have hitherto been invented, those which are the most simple in construction seem to have succeeded best. Michaelis recommended that a large sized gum-elastic male catheter should be used, to the eye of which the prolapsed cord is attached by a ligature, which is to be loosely drawn so as to avoid compression. The stylet is then introduced, and the catheter, carrying with it the cord, steadily pushed up in the direction of the fundus, where it may be left, the stylet being withdrawn, until the completion of labour. The contrivance of Mr. Roberton is, with a trifling modification, the same as this. A simple piece of flat whalebone has been preferred by some, and is as simple and as convenient as the other. Perhaps if we were to express a preference for one form over another, that used by Dr. Braun for many years in his *Klinik* at Vienna might be selected as combining simplicity and efficiency in the highest degree. It is made of gutta-percha, and is used as is shown in the accompanying figure. It is about sixteen inches in length, and has, about two inches from the rounded extremity, an aperture of sufficient size to allow the passage of a loop of tape or worsted, which, after being carried round the cord, is brought over the extremity of the instrument, and is then pulled so as to grasp the cord firmly without subjecting it to dangerous compression. The apparatus is then pushed as high as is possible in the direction of the fundus uteri, and is allowed to remain until the further descent of the head in the pelvis presents an effectual barrier to the prolapse of the cord. When we are convinced that this stage has been reached, the instrument is to be drawn down with a wriggling or shaking movement, by which the loop passes over the point, and the cord is left behind, while the whole apparatus is removed. Kiwisch effected the same purpose by fixing the point cut from a large catheter upon the extremity of an ordinary uterine sound; and we have tried with success an instrument of French construction, made of two parallel pieces of whalebone, of which the one slides upon the other, and has a sort of hook at the end by means of which the cord may be confined or released at will. The principle of the operation is in every case the same, and the varieties above mentioned are but a few of a large number which practical difficulty has suggested to different operators. We cannot, however, depend even upon the best of them for reliable and satisfactory results, and, in fact, we find that many experienced operators prefer the fingers in all ordinary cases, while Tyler Smith informs us that even Michaelis abandoned his ingenious instrument for the use of the finger. Be this as it may, we should always try, when the fingers fail, what we

Fig. 143.



Braun's Repositorium.

can do with a *repositorium*, hastily constructed though it may be from such materials as are at hand. The success attained by others is ample warrant for persevering efforts in this direction.

Postural Method.—This plan of treatment, although it has of late years come prominently into notice, is no novelty. Its value and importance were recognised by Camper and Deventer, both of whom perceived clearly the advantage which might be derived by raising the pelvis above the level of the fundus uteri, and thus taking advantage of the law of gravity. In more modern times, Van Ritgen, Bloxam, Thomas of New York, and Dyce of Aberdeen have, with others, borne testimony to the undoubted value of this as a method of treatment. The posture recommended is what is called the knee-elbow position, and, if it were possible for women to maintain so constrained a position for any length of time while suffering from the pains of labour, there can be little doubt that the results would in the main be highly satisfactory. In practice, however, it is difficult, indeed sometimes impossible, to prevail upon our patients to persevere in what to them is so irksome, and, when this is the case, a half-kneeling, half-recumbent posture has been suggested, the patient being supported by pillows, so as to raise the pelvis as high as the circumstances will admit. Full advantage cannot, however, be derived from the postural method unless the knee-elbow position be persevered in. It must not be supposed, however, that such treatment is in all cases satisfactory in its results. On the contrary, our expectations will often be disappointed, the propulsive force under certain conditions overcoming all the aid that gravity can afford us. In cases of special difficulty, it is probable that the best results will be secured by a combination of the postural method with some form of repositorium.

So long as vigorous pulsation shows that the life of the child is not in immediate danger—and this we should also ascertain by auscultation of the fœtal heart—we must not cease in our efforts to prevent the cord from descending into the pelvis along with the presenting part. M'Clintock and Hardy recommend that the woman should be made to lie upon the side opposite to that on which the protrusion has taken place. In addition to the means above detailed, the expedients which have been devised are endless. Among these may be mentioned partial plugging of the uterine orifice, after reposition, by a piece of sponge; and the enclosure of the coil of the funis, when unusually large, within a bag of some kind, the whole being then returned to the uterus and left there.

It is universally admitted that a certain number of cases do occur in which reposition of the cord is a practical impossibility, or would be attended with unwarrantable risk to the mother. Of such a nature are those cases—by no means of unfrequent occurrence—in which the accident is not recognised until the head has already descended far into the pelvis. For the management of such conditions no definite rules can be given; all will depend upon the peculiar circumstances of each individual instance. We must be guided mainly by the following General Considerations.

1. We must ascertain whether or not the child lives, for it must be obvious that a negative answer to this question bars all further action on our part. When the cord, therefore, is flaccid and pulseless in the interval between the pains, and the pulsation of the fœtal heart cannot be made out, we leave the case absolutely to nature, as we know that there is no danger to the mother, and we need no longer act in the interests of the child.

2. No conceivable circumstances will warrant us in subjecting the mother to any considerable risk. Practically, in an uncomplicated case, she is perfectly safe, so that to endanger her on the mere chance, or even probability, of saving her child, would be worse than absurd. It is, perhaps, true that there is no operative procedure whatever which is not attended with some increase of risk, be it ever so little. But, from a moral as well as a practical point of view, we must draw the distinction between slight and serious risk, and upon this distinction treatment will, in many instances, be based. The principle must, however, remain a general one, for the gradations between the two extremes are infinite, and each case should thus be decided on its own merits, and in full view of the whole facts.

3. When reposition is impossible, the simplest and safest mode of procedure is to guide the cord, as has already been stated, towards that part of the pelvic wall where it is least likely to be subjected to severe pressure; and, of all possible situations, the direction of that sacro-iliac synchondrosis which corresponds to the side of the child's head, if it be a cranial presentation, is perhaps the most favourable. The pulsations of the fœtal heart, and those of the funis, must now be carefully watched, as representing the condition of the child, and indicating the approach of imminent danger; and upon these observations will chiefly depend our future course of action. So long as the pulsations are tolerably strong, we are justified in leaving the process to nature; and, in the case of a woman who has previously borne children, or in whom the pelvis is of larger dimensions than usual, the perilous stage of labour will often be safely passed, and the child born alive; whereas in the contrary conditions of a primipara, or a narrow pelvis, the chances of a favourable result are comparatively small.

4. When a failure of the circulation is indicated by the stethoscope or the finger, our course of action will be suggested, in a great measure, by the stage at which the labour has arrived. If, in an ordinary cranial position, the os is fully dilated, and the circumstances are otherwise favourable for the operation, we need have no hesitation whatever in applying the forceps, and completing the delivery as rapidly as possible. In the case of the breech, the fillet or blunt hook may be used, with the view of expediting labour; but these, or other operations, are only to be attempted when the conditions are generally favourable, and the risk to the mother is not great. It is, of course, obvious that instrumental delivery in these cases involves the special danger which might arise from violent pressure on the cord, such, for example, as may result were the coil caught between one of the blades of the forceps and the child's head.

5. The question of Turning, in funis presentation, demands, as a disputed point in obstetrics, some special attention. In the early part of the present century, the operation seems to have been held in pretty general esteem, but in more recent times the other and safer modes of operative procedure are, when practicable, usually preferred. It must not, however, be supposed that the operation so warmly supported by Mauriceau is to be, under all circumstances, condemned. There are, in the first place, instances in which the operation must be performed in the interest of the mother, no less than in that of the child, and in respect of which, therefore, there can be no hesitation. Of this nature are cases of shoulder presentation and placenta prævia, both of which conditions are apt to be complicated with descent of the cord. Here we scarcely take the cord into consideration, so clear are the other indications; or, if we do, it is only to admit it as of secondary importance, but, at the same time, as an additional circumstance which calls for speedy action, so soon as the proper period shall arrive for the performance of the operation under the most favourable conditions. But, while such cases are clear, it is otherwise when, in a cranial presentation, the question of turning offers itself for our consideration in the interests of the child alone, other modes of procedure being impracticable. The opinion generally entertained is, that under the circumstances to which we allude, we are rarely warranted in turning—a view which we believe to be, in the main, correct. That there are exceptional instances, however, in which, after other means have failed, we may be justified in performing the operation in question, we cannot dispute; more especially perhaps in the case of primiparæ, where we may expect the pressure on the cord to be exceptionally great. There is perhaps no one point in regard to presentation of the funis which calls for more careful con-

sideration and judicious balancing of the special circumstances of individual cases. A capacious pelvis, a yielding and moderately dilated os, and other conditions favourable to the operation itself, afford strong presumption that turning may be effected without any great risk to the mother. The period may not have arrived at which the idea of forceps can be entertained, and yet the child is in a state of immediate peril, so that the question may simply be :—Are we to act, or to leave the child to its fate? Here, experience, and the habitual caution which matured experience engenders, can be the only safe guides. We repeat, however, our conviction that cases do occasionally occur in which we would be justified in turning at once. We must not forget, while forming our resolution, that the operation does not necessarily, even under the most favourable circumstances, relieve the child from danger. For, the operation being performed, there is still the critical period of the passage of the head, during which, although everything be done which skill can achieve, the child, already enfeebled, may succumb from the renewed pressure on the cord.

CHAPTER XXII.

PREMATURE EXPULSION OF THE OVUM.

ABORTION; *Definition of.—Causes: in General Health: from Reflex Irritation: from Diseases of the Ovum: from Action of Oxytocics: from Affections of Neighbouring Organs: from Mechanical Violence.—Habitual Abortion.—Symptoms at Various Periods.—Precursory Symptoms: Pains: Hæmorrhage: to be distinguished from Delayed Menstruation.—Signs of Death of the Fœtus.—Distinction to be drawn between "Threatened" and "Inevitable" Abortion.—Retention of the Ovum.—Expulsion of the Placenta.—Treatment: Preventive: Prevention when Abortion Threatened.—Expulsion to be Promoted when Inevitable.—Management of Hæmorrhage, and of the Placenta: Placental Forceps.—Treatment of a Woman after Abortion.*

PREMATURE LABOUR.—*Special Causes.—Treatment.*

ALTHOUGH the usual duration of pregnancy is ten lunar months from last menstruation, the ovum may be expelled at any time by premature uterine action, the result of the operation of certain special causes. *Abortion,* in the sense now ordinarily attached to the term, is the name which is applied to the occurrence, when it takes place before the eighth lunar month, while *Premature Labour* occurs during the last three months of gestation. Many writers have confined the term "abortion" to the first sixteen weeks, and apply the word *Miscarriage* to the period between that and the twenty-ninth, but it is more convenient to adopt the simpler classification, which has the further advantage of allowing the familiar expressions "non-viable" and "viable" to be used, as applicable to the fœtus, in connection with the periods of abortion and premature labour respectively. Miscarriage is a term familiar to women, and is used by them as synonymous with abortion in the wider sense in which we prefer to use the latter.

Abortion.—Strictly speaking, abortion may take place at any moment subsequent to conception. Should the one supervene immediately upon the other, or within the first few weeks, no symptom is likely to be manifested which would attract particular attention, and the blighted ovum in such cases may be as impossible of detection as the ovule which is thrown off at a menstrual period. If the ordinary catamenial period, in a woman previously regular, should pass, her suspicions may be aroused; but, if a discharge manifests itself in a few days thereafter, it is assumed that the period has been delayed, and this may be held further to account for the increase in the quantity, and of the pain which accompanies it, as compared with the symptoms attendant upon the ordinary menstrual flux. In point of fact, it is rare that the abortions of the first three or four weeks from the assumed date of conception attract such attention as to be brought under the notice of the medical attendant. Even during the course of the second month, the symptoms, although more distinct, may be overlooked, and the woman, who is seized with considerable discharge and uterine pains of a periodic character in the seventh or eighth week, may be quite unaware that one of the clots which have been expelled contains the immature ovum. To the earliest abortions, the ancients gave the name of *Effluxio*. When it is said, therefore, that abortion occurs most frequently from the eighth to the twelfth week, we assume that the earlier abortions are not taken into consideration, for in truth we have no means whereby the number of the latter may be even approximately computed.

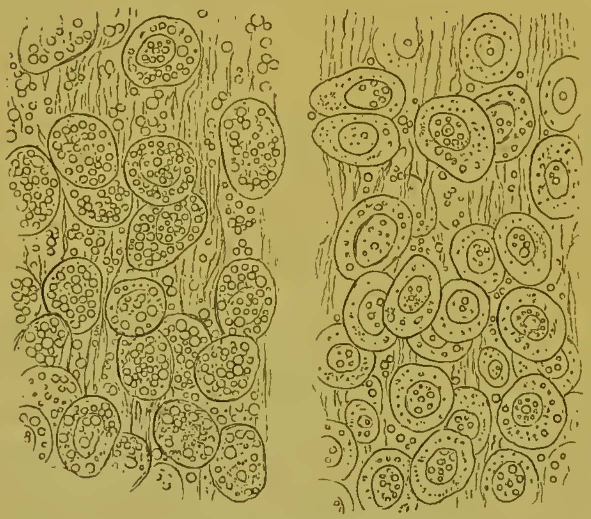
The liability to abortion is undoubtedly greater in the earlier months of pregnancy, when the union between the chorion and the decidua is of a lax character, so as to admit readily of hæmorrhage into the space between them, with the result of cutting off the temporary communication which exists between the mother and child before the formation of the placenta. Fortunately, however, the earliest and most frequent abortions are not attended with much risk, as the ovum usually escapes entire; and the hæmorrhage which accompanies them, and which proceeds from the vessels of the decidua, is rarely such in extent as to cause any great alarm. In the latter part of the abortion period—the sixth and seventh lunar months—the symptoms manifested and treatment required are so analogous to what obtains at the full time, that few special directions are necessary for their proper management. It is quite otherwise, however, in regard to abortions which occur in the middle period—say from the tenth to the eighteenth or nineteenth week. In these cases we have special dangers to dread, and, if possible, to avert, which separate this from any other period of abortion. These dangers are dependent upon special conditions which it is necessary carefully to observe and to understand, and the most important of them is the development of the vascular relations between the maternal and fœtal systems, connected with the formation of the placenta.

Causes of Abortion.—The causes of abortion must, before we go further, engage our attention. These are very numerous, and, being both general and local, may act in a very variable manner in inducing the premature action of the uterine fibres upon which the expulsion depends. Many obvious causes are to be traced to the general health or temperament of the mother. In so far as the familiar affections which so frequently attend early pregnancy are concerned—such as sickness, faintness, salivation, and the like—and which, when extreme, are considered among the diseases of pregnancy, it has always been observed that these are very rarely the cause of abortion. The most common of all—sickness—is, even in the worst cases, little liable to be followed by premature expulsion. "It is," as Dewees says, "a remark as familiar as it is well-grounded, that *very sick women rarely miscarry;*" and when we see, in some instances, strong and apparently plethoric women miscarry, who have not been sick, we may feel inclined to share the general impression that sickness is a safeguard, and possibly keeps down morbid irritability or rigidity of the uterine fibre. With these exceptions, however, it may be assumed that whatever deteriorates the general health of the mother is apt to produce abortion, or, at least, to place the woman in such a condition that she is more susceptible to the influence of other causes which may then come into play. Any serious disease, whether acute or chronic, may be the direct cause, and the general symptoms which accompany the original disease may be greatly aggravated by the occurrence in question. Many febrile disorders are extremely liable to lead to abortion, more especially small-pox, relapsing fever, and scarlatina; and in too many of these cases there is a fatal issue. Of chronic diseases, none, perhaps, exercises a more marked influence than syphilis, which actually seems to poison the ovum, and is certainly associated, in many instances, with various forms of disease and degeneration, of which it is the seat. But it is not from the mother alone that such influences proceed; for the ovum may be infected by the poisoned spermatic fluid of the male; and, in some cases stranger still, it would appear as if the woman were a mere conductor of the contagious principle. As an illustration of this, in the case of small-pox, Mauriceau tells us that, shortly before he was born, his mother had the misfortune to lose the eldest of her three sons by this disease, and that in spite of her condition, as women will do, she tended him with constant and tender care. Mauriceau was born the day after his brother's death, and, although his mother, neither then nor subsequently, presented the slightest symptoms of the disease, he had on his body at birth, five or six undoubted variolous pustules.

Reflex Irritation, from a variety of sources, is one of the most frequent causes of premature expulsion of the ovum. The irritation may start from any part of the alimentary canal, and in those instances the nature of the case may be revealed by the existence of dyspepsia, diarrhœa, dysentery, or intestinal worms. In cases of protracted or injudicious nursing during pregnancy, it may have its origin in the nipple by irritation of the mammary nerves. But, besides such distant sources of irritation, reflex action may, undoubtedly, be induced by direct irritation of the vagina, as in plugging; or by irritation of the uterus itself, as is effected, in fact, by the contact of a dead or diseased ovum. Illustrations of this variety of case might be indefinitely multiplied. "We may consider," says Tyler Smith, "abortion from reflex action as being, in some points of view, comparable with spasmodic asthma, or any other excito-motor disease. From certain irritating causes, an excitable condition of the excito-motor arcs concerned in parturition is induced. This state of excitability once produced, slight causes, which would, in healthy subjects, produce no disturbance whatever, are sufficient to produce morbid or spasmodic parturition. This excitability is not suddenly reached. It requires that the nervous arcs, whether mammary, rectal, or other, should be irritated for a considerable time, when an excitable, charged, or polar state of the uterine nervous system seems to be produced. The period preceding a case of reflex abortion may be likened to the time preceding an epileptic attack." When the reflex irritation has its origin in the ovaries, there is a tendency to the separation of the ovum at what would have been a menstrual period—a fact which, taking the identity of the decidua and the mucous membrane as a matter of undoubted certainty, seems to confirm the views of those who hold that menstruation involves a periodical discharge of that membrane. This particular cause seems, moreover, to occur, for the most part, in those who have suffered, before impregnation, from some form of dysmenorrhœa.

Abortion is clearly associated in some cases with certain Diseases of the Ovum. Those have already been incidentally referred to in speaking of the diseases to which the embryo is subject. That fatty degeneration of the chorion and placenta has a marked and decided influence, has been established beyond doubt. The particular variety of this degeneration which exercises the most undoubted influence upon the ovum in inducing premature expulsion consists in a metamorphosis of portions of the maternal and fœtal structures of the placenta. This may occur at any period of intra-uterine life, and the appearances presented by the cells of the decidua in the healthy and degenerated placenta are indicated in Fig. 144, where the two are similarly magnified and shown in juxtaposition. It is unnecessary to follow the minute and interesting series of changes which have been traced in reference to this form of degeneration. It seems, however, to be clearly proved that it is frequently induced by constitutional syphilis. The decidua, placenta, and other parts of the ovum are, like all other vital textures, liable to congestive and inflammatory affections, which may arrest the vitality of the fœtus, either by inducing some of the various forms of degeneration, or by causing sanguineous effusion into the tissue of the placenta, which has occasionally been found to contain purulent deposits. When the blood effused is considerable in quantity, it constitutes what Cruveilhier has described under the name of Apoplexy of the Placenta, which, by interrupting the circulation, may cause death of the fœtus, and, consequently, inevitable abortion, although the fœtus may be retained *in utero* for a considerable time, while the degenerated structures of the ovum undergo further change. Any of the numerous diseases to which the fœtus is liable may cause its death, and it is believed that twisting or knotting of the cord, either upon itself or round the neck of the child, may have a similar result. Like the placenta and other tissues of the ovum, the cord too is subject to special diseases, in the course of which its function is destroyed. Besides this, the facts stated by Mauriceau, Stein, and others seem to prove that the cord, when too short, may be so dragged upon as to endanger its integrity.

Fig. 144.



Cells of Fatty and Healthy Decidua.

Among the causes of abortion, we must not omit to mention those agents to which the name of Oxytocics has been given. The more familiar of them are the ergot of rye, borax, and savin, which, with some others, exercise an undoubted effect upon the muscular tissue of the uterus. The nature of their action is not thoroughly understood;

but it is certain that ergot, and probable that the others, exercise a marked influence upon the spinal cord. Through this channel, then, we may infer that the oxytocic influence passes, which excites the uterus to contraction. The uterus is, however, not nearly so obnoxious to the action of these agents as when the organ is fully distended, either at the end of pregnancy, or from any other cause. A similar action is produced by carbonic acid, as has been abundantly proved by the records of cases of accidental or intentional poisoning. A precisely similar effect follows the retention of carbonic acid in the blood in asphyxia—a condition under which expulsion of the ovum has very frequently been found to occur. Of the five hundred Arabs who were suffocated in the caves of Dahra, in 1845—as is said, by the orders of the Duc de Malakoff—a considerable proportion were women, of whom some who were pregnant were found to have aborted; and other instances of a similar nature have also been recorded. The same fact has been proved experimentally by the researches of Dr. Brown-Séquard, who further believes, as we have already stated, that the oxytocic action of carbonic acid is the determining cause of labour at the full term, exciting, by the direct contact of venous blood, the irritable uterine fibre to contract. Emotional causes, such as joy, grief, anger, and the like, may produce an effect precisely similar. In some cases of *auto da fé*, and other barbarous acts by which the victim perished at the stake, abortion has also taken place, partly, as is probable, the result of fear, and partly by the action of asphyxia.

Certain affections of neighbouring organs may produce the premature expulsion of the ovum. In many of these cases, it would seem as if the cause was a purely mechanical one. Tumours, adhesions which bind down organs that ought naturally to rise with the uterus, and anything, in fact, which may mechanically hinder the development of that organ, may act in the same way. Displacement of the uterus itself may act in the same manner; and we have known cases of uterine retroversion, for example, in which abortion had occurred several times, and in which an ovum only reached maturity after the displacement upon which the abortion depended had been cured by appropriate treatment.

Premature expulsion of the ovum may also follow the occurrence of accidents or mechanical violence of any kind, such as falls and blows, and these cases are important, as the symptoms which accompany abortion differ in them from the other cases previously detailed. Such causes may act in either of two ways:—by an effect produced on the organs or tissues of the mother, or by injury to the fœtus which may cause its death. It has been denied by some authors that the latter is a possible cause, so admirably has nature provided against the effects of accident and shock. We do not speak now, of course, of extreme violence, but of such only as may afterwards operate as a cause of abortion. The following case, given by Cazeaux, is conclusive as to this :—"A young woman, six months pregnant, while groping in the dark in her room, struck the abdomen violently against a table. During the night the movements of the child became suddenly very violent, then diminished, and the following day were no longer felt. Two days afterwards she was delivered of a dead child, which presented on the back an ecchymosis as large as the palm of the hand." Burdach gives the case of a woman who, in the sixth month of pregnancy, had received a blow on the lower part of the belly, of sufficient violence to fracture the fore-arm and the leg of the child: pregnancy went on to the full time, and the fractures were found at birth to have united at an angle. The effect of such accidents as tell directly on the maternal parts is more obvious. Nothing, however, is more astonishing than the amount of violence which women may suffer with perfect impunity, in so far as pregnancy is concerned. Falls from windows, giving rise to severe contusions and fracture of the limbs, have repeatedly occurred to women who were pregnant, without causing abortion. The late Dr. Pagan used to tell of an instance in which his coachman drove right over a woman who was in the eighth month of pregnancy, inflicting upon her very serious injuries. His master, thinking that premature delivery must of necessity follow, caused frequent inquiries to be made, and found ultimately that the pregnancy was in no way disturbed, and that the woman was delivered of a healthy child at the full time. The slowness with which the uterus responds, in many instances, even to considerable irritation, is familiar to those who have had occasion to induce premature labour; and the fatal result, in cases of criminal abortion, is, no doubt, mainly due to the amount of violence which is resorted to, in the hope of exciting the contractions which milder measures have failed to induce.

Habitual Abortion.—A disposition which is exactly the opposite of this exists in some women, who, so to speak, abort upon the slightest provocation. That in many of those cases of habitual abortion, there is some anatomical or physiological cause upon which the phenomenon depends is more than probable; and in all those instances in which there exists a mechanical impediment of any kind, it may follow impregnation periodically, almost as a matter of course. But, putting such aside for the moment, there are other, and by no means rare, instances in which we can only account for the repeated abortions by supposing that the uterus has contracted an inveterate habit. It is, perhaps, one of the most familiar observations in obstetrical practice, that a woman who has previously aborted is much more liable to miscarry. And, when abortion has occurred in several successive pregnancies, we look upon each recurrence of that condition with considerable apprehension as to the issue of the case. In such, it is very generally observed that the tendency to separation of the ovum is greatest at a certain period of pregnancy; and every accoucheur of any experience can recall cases in which successive ova were thrown off at exactly the same age, as calculated from the presumed period of conception. It would thus seem as if, in those cases in which no obvious cause can be detected, there was some perverted condition of the uterine fibre, as regards irritability, which prevented dilatation of the viscus beyond a certain point, analogous to what obtains in morbid irritability of the bladder, when the desire to micturate occurs long before even moderate distension has taken place. And, in the latter case too habit has something to do with it, while resisting the call has, sometimes at least, a beneficial effect. In the case of the womb, however, voluntary resistance has no effect, and so the act goes on repeating itself if unchecked.

If those above detailed embrace the chief, they are far from representing all the causes which may possibly lead to premature expulsion. This would require a special treatise. Enough has, however, been said to enable us to apply the principles of treatment, to which, without a knowledge of the etiology of the subject, we could by no possibility attain.

Symptoms.—These vary somewhat according to the cause and the period of pregnancy. One of the most constant symptoms of all cases is pain, but in some instances the expulsion seems to be accompanied with little pain or even discomfort. In very early abortions, the pain may be no more than that which attends an ordinary menstrual period. The seat of the pain is usually the lumbar, sacral, and hypogastric regions, but it may extend to the groins and down the thighs. A trifling increase in the amount of the catamenial pain, and the presence of some solid masses along with the discharge, may be the only symptoms which attract attention, and are not unnaturally mistaken for those which accompany a delayed menstrual period, when the ordinary functions of the parts are shortly resumed as before. At a more advanced period, the symptoms are, as might be expected, more marked. The occurrence is then sometimes ushered in by a rigor, followed by an increase of temperature and in the frequency of the pulse, thirst, and sometimes nausea, even when this has not been present before. Other and more vague symptoms, such as palpitation, cold extremities, dimness of vision, and dark rings surrounding the eyes, have also been noticed. A cold uneasy feeling about the pubes, with more or less of weight in the same region, according to the size of the embryo, is looked upon, and with justice, as a characteristic and important sign. Lumbar pain and vesical tenesmus are also of frequent occurrence. If they should have been present, there is a cessation of what are recognised as the breeding symptoms: morning sickness is no longer complained of, and the mammæ usually become flaccid, although the pain in these glands is sometimes considerably increased.

Those symptoms are in their nature precursory, but are soon succeeded by increase in the lumbar pain, which becomes periodic, and extends to the hypogastric region. If the fundus can be distinguished behind the pubes, it will now be felt to contract, indicating the commencement of uterine expulsive effort. If a discharge of an hæmorrhagic nature has not previously taken place, that symptom will now be observed, the amount of the discharge varying very greatly—depending, no doubt, on the extent to which the ovum has become separated from its attachments. An examination should now be made by the finger; but this must be conducted with great caution, as any roughness of manipulation might make matters worse, by exciting the uterus to more energetic action, or, possibly, by rupturing the thin sac which contains the liquor amnii and the embryo. The os and cervix will be felt to be softened to an extent commensurate with the period at which the pregnancy has arrived; and, in addition, the os will be found more or less patent.

Delayed Menstruation Distinguished.—In the earlier periods of pregnancy, we may have some little difficulty in making out whether the woman is pregnant or not. In many cases, therefore—in unmarried women for example—we must be very cautious in expressing an opinion on this point, however suspicious the symptoms may appear to be. According to Madame Lachapelle, the following points are of importance in establishing a distinction between the two. If the case be one of abortion, the os is more or less open; hæmorrhage usually precedes the pains, and gives them no relief, but, on the contrary, they become more severe as the case advances. If, on the other hand, the case be one of delayed menstruation, the os is nearly closed, or is at most very slightly opened: the pains precede the hæmorrhage, and are diminished upon its occurrence, or may entirely cease when it is thoroughly established. These points are, no doubt, of importance, but are to be received in evidence with caution. Certain other rules are given with the view of enabling us to distinguish between a clot and an ovum in a digital examination at the os uteri, but these are of little if any practical importance, seeing that both a clot and the ovum may, and often do, present simultaneously.

As the case progresses, and the rhythmical uterine contractions continue and increase in energy, the os dilates still further, but the dilatation is often very tedious. At the period of pregnancy at which abortion occurs, the anatomical condition of the cervix is such, that its distension by the uterine efforts is effected under circumstances of comparative mechanical disadvantage. The conditions at least are widely different from the termination of the period of gestation, when the circumference of the external os is the only point against which the uterine efforts are directed; and, although the dimensions of the body which is to pass are to be taken into consideration, the wonder is that the difficulty of dilatation is not more universally marked. The rupture of the membranes is somewhat irregular in its occurrence, but if these remain intact, they will often be found to protrude in a manner similar to what obtains in labour at a more advanced period. In the course of the first few weeks, the ovum is generally expelled entire, which, indeed, is a most favourable occurrence, and accounts for abortions of that period being comparatively free from danger to the mother. When the membranes rupture, the embryo is expelled, and may be followed at a variable interval by the secundines. Or the latter may be retained for a longer period, to give rise to symptoms and difficulties which will require for their management all the skill and judgment which we have at our command.

As a general rule, the death of the fœtus precedes the uterine contractions which cause its expulsion. In other cases, again, the fœtus is born in such a condition as would seem to indicate that it had only perished while undergoing the process of expulsion; and, in a third class, chiefly the result of accidents, it is expelled alive, and may move briskly for a few hours after its birth.

It not unfrequently occurs that the symptoms which indicate the death of the fœtus are separated by a considerable interval from those which accompany the expulsive phenomena. When the former, the more important of which have already been detailed, have been distinct and unequivocal, the sequelæ, or external manifestations of abortion, are always to be looked for, usually after an interval of some days. When the woman has received an injury, or has otherwise been subjected to violence, the ovum may, if it be a very early abortion, be expelled almost immediately. If, however, it has attained any size, a certain interval must elapse, when, upon the death of the fœtus, a similar but more gradual result will ensue, the mechanism of the expulsion being essentially the same as in the other case. It is in the cases in which the cause has been one rapid in its operation that the child is most frequently born alive. Whatever the cause may originally have been, if it acts by first destroying the life of the fœtus, the latter plays the part of a foreign body, and, as such, excites the uterus to contract. "The living fœtus," says Rigby, "obeys the laws of organic life; the dead fœtus those of gravity. When once the child has ceased to exist, it acts like any other mass of inanimate matter;" and this too is the reason why the feeling of weight is so frequent, and upon the whole so reliable a symptom in the more advanced periods at which abortion may occur.

Abortion Threatened, or Inevitable.—The symptoms of abortion call in every case for careful observation and attentive consideration. The most important practical point which may arise is the following:—We shall suppose that no doubt is entertained as to the fact of pregnancy, while the symptoms are clearly those of abortion. But are the symptoms those of threatened abortion only; or do they imply that the loss of the ovum is inevitable? In the former case, we must do all we can to avert the expulsion; in the latter, we do all in our power to promote it: hence the importance, nay, the necessity of recognising the special symptoms which enable us to distinguish the one class of cases from the other. If we are called to a case of abortion at the onset of the symptoms, we may assume that the loss of the ovum is seldom inevitable unless it is dead. Nothing, therefore, short of clear evidence of the death of the fœtus will warrant us in abandoning all effort to save it. The danger depends for obvious reasons upon the extent to which separation has taken place between the ovum and the uterus. Whether the ruptured vessels are decidual or placental, the maternal vascular supply for the nutrition and respiration of the fœtus is more or less restricted by the rupture of the connecting vessels. No symptom, therefore, is of greater importance than the amount of hæmorrhage which has occurred, as this may be held to indicate with tolerable certainty the extent of the separation and rupture of the tissues from which the blood flows. The quantity of the discharge is much more important than its duration, so that, whereas, in the former case, we despair of the issue, or at least look forward with much apprehension, in the latter we will often meet with instances in which a moderate or trifling amount of discharge may persist for many days without the slightest effect being produced in arrestment of the process of gestation. Profuse hæmorrhage, then, recurring, at short intervals, and accompanied with pallor, vomiting, and a tendency to syncope, indicates extensive separation of the ovum, and proportionate gravity in the nature of the case.

Uterine contractions may not only be present, but may persist for a considerable time; but we should never, on this account alone, place the case in the "inevitable" category, as the symptoms sometimes subside spontaneously, and often do so under appropriate treatment. Rhythmical uterine contraction, however, is always a most alarming sign, and more than sufficient to cause anxiety; but the significance of this as an isolated symptom will chiefly depend on the vigour and continuance of each successive pain. Of greater importance is the condition of the os. If this is agape, with some portion of the ovum already protruding, prevention is out of the question. Even although we fail to reach any portion of the ovum, if the os is widely patent, we recognise in that fact evidence, which, if not conclusive, is at least strongly presumptive of abortion; while, on the contrary, if the cervix is but slightly dilated, and its cavity has as yet been but little encroached upon, our hopes of a favourable issue are greatly strengthened.

One of the worst indications possible is in the discharge of the liquor amnii, and in fact, when we can be sure that this has taken place, we may abandon all hope. Evidence of rupture of the membranes must, however, be carefully sifted. The assertion of the patient on a point such as this may go for nothing. The observations of an intelligent nurse are, of course, of greater value; but we must be cautious even then, as the possibility of hydrorrhœa and discharges from other sources must be admitted and disposed of before we can speak with confidence. If, with discharge of the waters, we have a gaping os, profuse hæmorrhage. and obliteration of the cervix uteri, the case may be given up, and our efforts directed into a new channel, with the view of expediting the process which, under more favourable circumstances, it would have been our duty to oppose. With intact membranes, closed os, trifling hæmorrhage, and moderate or irregular uterine contractions, our prognosis may be favourable, but is to be expressed with caution, as graver symptoms may at any moment supervene.

In most cases of abortion, the expulsion of the ovum is slow, and it thus happens that the ovum, or a portion of it, is sometimes delayed for days in the orifice of the os. In so far as danger from hæmorrhage is concerned, the death of the fœtus some time prior to its expulsion is an advantage, as the utero-placental vessels atrophy, and there is thus little danger of hæmorrhage—less even than in labour at the full time. Or, if the supply of blood be continued as before, it is misapplied, and results in the morbid development of the parts and the formation of a mole. In some cases, again, the death of the ovum is not followed by its expulsion, but it is retained for many weeks, or even months. At a very early period, the delicate tissues of the embryo are dissolved in the liquor amnii, and are said then to form a gummy solution. At a later period, it shrivels or dries up like a little mummy, and may remain unaltered in this condition during the remainder of its sojourn in the womb. In other cases, it assumes the saponaceous and withered appearance, without any putrefactive odour, so graphically described by Devergie, which is apparently analogous to that variety of putrefactive change, which the same eminent medical jurist has described under the name of adipocere. In these cases the woman may experience but little uneasiness, or may be perfectly unconscious of anything unusual. She and her attendants may suppose that the ovum had passed undetected, until, after a long interval, a mass escapes from the vagina, with or without pain, an examination of which at once reveals the nature of the case.

Retained Placenta.—Apart from the danger arising from hæmorrhage before abortion, the peculiar circumstances which attend the Expulsion of the Placenta are of the highest importance, and differ in many essential particulars from the corresponding phenomena of labour at the full time. "In all cases, the placenta is retained much longer after the expulsion of the child in abortion, than in labour at the full time." Thus wrote Burns, and his assertion is undoubtedly correct; but we must here make a distinction between the different epochs of abortion. It is, as has already been remarked, to the middle term of the abortion period that our attention requires more particularly to be directed. At this time the placenta forms a close anatomical connection with the uterine tissues and with the maternal vascular apparatus, connections which are often to be severed only with the greatest difficulty. The uterine contractions suffice, in many instances, to burst the ovum and discharge the fœtus, and when the cord breaks or is tied, uterine action ceases. But instead of a speedy recurrence of the pains, and a natural and unaided expulsion of the placenta, the uterus remains quiescent, the os closes, and the placenta, with the membranes, is retained, sometimes for hours only, but often for a much longer period, extending to eight or ten days or even more. The absence of pain, and of other symptoms of importance, may induce the woman to believe that she is perfectly well, and we may on this account have some difficulty in convincing her of the necessity which exists for perfect rest. A return of the pains, after a very variable interval, marks a renewed attempt on the part of the uterus to rid itself of its contents. If a considerable time should have elapsed, the os will have closed so firmly that a tedious process, which is conducted at great mechanical disadvantage, is necessary for its dilatation. This process is often attended with alarming hæmorrhage, as it is only now that the utero-placental vessels are being severed, and this hæmorrhage may only cease upon the expulsion or extraction of the placental mass.

Should there be no effort at expulsion, the placenta will usually become the seat of putrefactive changes, a condition which will be manifested by the occurrence of a dark and fœtid discharge. Under the influence of this, the structures may be broken up and discharged piecemeal; but the process is always tedious, and may be accompanied by low fever, in consequence of which the woman may become reduced to a condition which may excite considerable alarm, and there is of course the danger of what fortunately does not often occur in such cases, viz., blood poisoning through the uterine veins. A similar condition, as regards discharge and general symptoms, may also supervene in those instances in which the membranes rupture, and the fœtus, as well as the placenta and membranes, is retained, the access of atmospheric air in this as in the former case giving rise to putrefactive decomposition. It is said that, in some cases, absorption of the placenta occurs, and in this way the uterus may get rid of its contents. "In cases of twins," says Burns, "after one child is expelled, either alone or with its secundines, the discharge sometimes stops, and the woman continues pretty well for some hours, or even for a day or two, when a repetition of the process takes place, and, if she has been using any exertion, there is generally a pretty rapid and profuse discharge. This is one reason, amongst many others, for confining women to bed for several days after abortion. The second child may, however, be retained till the full time."

Inspection of Discharges.—There is one other point which is of great value in estimating the gravity of the symptoms supposed to be due to retained placenta after abortion. The accoucheur may have had no opportunity before this of personally ascertaining the facts of the case, and may therefore be grievously misled by the details with which he is furnished. Nothing is of greater importance in the earlier abortions than that all clots and solid matters which escape should be carefully preserved for examination; but, unfortunately, this is seldom done. We may thus be in no small measure perplexed by the doubt whether the imperfectly formed placenta and embryo, or the placenta alone remain behind. The history which we may receive from the woman or her attendants must therefore be cautiously received, as quite circumstantial details are sometimes given of the expulsion of the embryo, and yet the issue of the case may show that the presumed ovum can have been nothing but a clot, the layers of which may have appeared to resemble the membranes which enclose the product of conception. Important information is almost always to be derived from a careful inspection of the discharges, and all clots should be washed and carefully examined with a view to the discovery of shreds of membrane, fragments of placenta, or structures which show, more unequivocally still, the nature of the case.

Treatment.—The treatment of abortion may be arranged under two heads:—1st, to prevent it when that is possible; and, 2nd, to favour expulsion when this is inevitable—under which we may include the management of the placenta.

The Prevention of abortion may, as a practical question, be presented for our consideration under various forms. In the case of the woman who has aborted on several occasions successively, our treatment is, in the strictest sense, preventive, and must be commenced long before actual symptoms of abortion are manifested. In regard to this particular branch of treatment, while there are certain general principles upon which the management of all cases must be based, there are, at the same time, special considerations, which must not be lost sight of, as applicable to individual cases. A careful investigation of the causes which may have induced, on former occasions, the premature expulsion of the ovum, will sometimes point to the special considerations alluded to. There is a great tendency, in those cases of repeated abortion, to the separation of the ovum at the same period of gestation. This law operates with great force in cases in which there is no cause in the constitution of the mother, nor disease in the ovum, to which it can be attributed; so that, in some instances, the uterus actually seems, as it has often been expressed, to have contracted a habit of periodical abortion. The general principles, then, which guide us have their origin in this fact, and the treatment of every case is more or less based upon it. The object is, if it be possible, to tide over the period of former abortions, and, when this can be successfully effected, the pregnancy will often progress, and reach the full time, without the occurrence of a single bad symptom. If we can only succeed in breaking the habit—be the ultimate result of the pregnancy what it may—we have achieved something in the way of success; and we have known more than one instance in which the result of treatment was, in the first place, to transfer the period of abortion from the third to the fifth month, and on the occasion of the next pregnancy, a repetition of the same treatment was attended with the most satisfactory results possible.

In effecting our object, in the circumstances now under consideration, rest must be placed first among the remedial agencies in which we may trust. The strictness with which we enjoin rest will depend, in a great measure, on the number of previous abortions, and the extent to which preventive measures have already been adopted. In the worst, or most obstinate cases, nothing will do short of absolute confinement to bed, in the recumbent posture. When the woman has aborted but once or twice, it is by no means necessary that absolute rest should be so strictly enforced; but, in every case, the chief care is to be directed to the period at which previous accidents occurred. Something will depend on the effect which want of exercise may have on the general health, and if any deterioration should be observed in that direction, it becomes a matter of consideration, whether we are not doing more harm than good by the course we are adopting. And, moreover, there are many cases in which the circumstances of the patient render it, for her, an impossible matter to abstain from all physical exertion; and there are others again, in which we have to take into consideration the amount of energy which exists in the temperament of the patient, as it is clear that the woman who leads a life of irrepressible energy will require more restraint than one who is languid and disinclined to exertion. There can be no doubt that the tendency to abortion is much greater at what would, under other circumstances, have been a menstrual period, so that at these epochs at least we should use all our influence and authority to induce our patient to submit to the restraint which absolute rest implies. There are other causes which, no less than physical exertion, must be avoided, as far as is practicable. Among them are emotional causes, and any local irritation which might, by any possibility, act reflexly in the direction of the uterus. Irritations of the skin, bladder, or alimentary canal, are of this nature, and even such distal irritation as toothache has been known to act in a similar manner. A careful inquiry into the circumstances which attended former abortions should always be made; and, if it is found that diarrhœa, vesical irritation, or any similar affection, was a prominent symptom, as these sometimes are, it will be proper narrowly to watch, and if necessary to rectify, the function which may thus have been disturbed. Separation *a thoro* is in most cases proper, and in some indispensable; and, if necessary, the patient should be cautioned against the effects of tight lacing.

In women who are constitutionally weak, or apparently cachectic, a tonic treatment is, in addition to the precautions just mentioned, held to be proper. Some Spas, chiefly chalybeate, enjoy a certain reputation in such cases, and tepid or cold sea-bathing, both before and after conception, was strongly recommended by Mr. White of Manchester. But, while the general health of the woman is thus attended to, we must not overlook any special constitutional causes which may be in operation. The most important of these is undoubtedly syphilis, and the best chance of success in dealing with such cases is—whether the mother or father, or both, be affected—to bring them gently under the influence of mercury before coitus is again permitted. An examination of the structures expelled in former abortions may seem to call for certain special means of treatment in addition to the general course of procedure above indicated. Diseases of the placenta or membranes act upon the fœtus mainly by interfering with the oxygenation of the blood. It has been proposed, therefore, that an attempt should be made to introduce a superabundance of oxygen into the maternal blood—an indication which it has been attempted to fulfil by inhalations of oxygen, or by the exhibition of such substances as contain a large proportion of oxygen in a state of feeble combination. It was with this object that Dr. Bower prescribed nitric acid, and Sir James Simpson chlorate of potash. In the case of other diseases of the ovum or fœtus, such as meningitis or peritonitis, mercury and other drugs have been prescribed on an analogous principle, in the hope of affecting the fœtus through the maternal circulation, but so many difficulties are in the way of correct diagnosis in such cases, that little can be hoped for in the way of successful treatment. Indeed, with the single exception of the treatment of syphilis by mercury, we can place but little reliance on the medicinal treatment of habitual abortion, beyond what is administered with the view of giving tone to the system, or allaying constitutional disturbance. We must not, however, even where nature seems to defy us, in any case despair of success. Dr. Young of Edinburgh tells, in his lectures, of a case in which the patient actually miscarried thirteen times, and yet bore a living child the fourteenth time. In the most obstinate cases, a year's marital separation should be enjoined.

The prevention of abortion extends, although in a somewhat different sense, to the treatment of cases in which the symptoms of impending abortion have already manifested themselves. Having taken due cognizance of the symptoms which enable us to decide whether or not the loss of the ovum is inevitable, and being persuaded that there is room for hope, the efforts of the accoucheur will chiefly be directed to the expulsive contractions of the uterus. The success of his treatment will in fact depend upon the power which the remedies he may employ will exercise upon this function of the uterus. Should any source of irritation exist, he must at once attempt to remove or allay it. The most perfect quiet of body and mind is more important perhaps than anything else. The patient should lie on her back on a hard mattress, and be kept cool. She should change her position as seldom as possible, for any exertion however slight will often be attended with a gush of blood. Her food should be light and easy of digestion; and not only stimulants, but animal food should in most instances be forbidden to her. Hæmorrhage is one of the alarming symptoms which we desire to arrest if it be possible, and on this account it is well to give the food cold, or at least cool. Caution must, however, be exercised in the use of ice, either internally or externally, for if, as is sometimes done, all the food is iced, and, in addition, cold affusion and injection resorted to, we may excite reflex action of the uterus, and thus defeat our ultimate object, although we may arrest the hæmorrhage. With the view of arresting uterine action, nothing can be compared with opium, which is indeed our sheet anchor. This has succeeded even in cases where the discharge was alarming, and the os open to a considerable extent. To secure the full advantage of its sedative action, it must be given in full doses, so that forty minims of the Liquor Opii Sedativus in two doses, at an interval of twenty minutes, may be given in most cases without the slightest hesitation. This preparation has, we believe, the advantage which Rigby claimed for it over the other preparations of opium, that its sedative effect is more sure, and that it produces less irritation and derangement of the stomach and bowels. In other cases, again, in which it may be inadvisable to give opium by the mouth, an ordinary enema of starch with a drachm of laudanum will be preferred; and, in point of fact, the possibility of having a local in addition to a constitutional effect, when it is administered in this way, will probably cause many to make choice of the method. Chloral, by the mouth or by injection, has also been employed with success. We must never despair so long as a chance remains of saving the ovum, bearing in mind that evidence of the death of the fœtus is an immediate warrant for suspending all operations which have for their object the retention of the product of conception. It is a safe and good rule, however, that so long as we are not sure that the fœtus is dead, we should act as if it were living.

When violent pains, profuse hæmorrhage, discharge of the liquor amnii, and progressive dilatation of the os, show that abortion is inevitable, the treatment differs widely from the above, as the object of it now is to promote instead of to prevent expulsion. In the course of this process, however, there are so many steps to be gone through, that it often requires great nicety and discrimination to conduct a case to a successful issue, which implies the safety and speedy recovery of the mother. In the first three months, the less we interfere the better. For, in these instances, as has been seen, the ovum often escapes entire, which is the most favourable occurrence possible; while, if we interfere too much in the way of careless manipulation, we run the risk of rupturing the membranes, discharging the liquor amnii, and thus causing a protracted retention of the whole or part of the ovum. The only symptom which is likely even thus early to call for energetic treatment is hæmorrhage. It is unusual at this period for loss of blood to be a cause of much danger or alarm; but, if it should be so, we should not hesitate to plug the vagina. Of the various modes of plugging, none is more simple or more effective than that which is recommended by Dr. Dewees. He advises that a piece of soft sponge, of sufficient size to fill the vagina without producing uneasiness, should be wrung out of pretty sharp vinegar, and introduced into the passage up to the os uteri: the blood in filling the cells of the sponge coagulates rapidly, and forms a firm clot, which completely seals up the vagina without producing any of those unpleasant effects which follow upon the insertion of a napkin rolled up for that purpose. Many persons, however, prefer to use the tampon or plug in the form of pads of carbolized cotton wool introduced through the speculum, and which, for easy removal, may be tied together like the tail of a kite. Others again have employed an india-rubber air or water bag, which, when distended, accommodates itself admirably to the irregularities of the vaginal cavity. There is this to be said in reference to the action of the plug, that, while it may be looked upon as universally applicable in all cases of alarming hæmorrhage, when all hope of saving the ovum has been abandoned, we should, if possible, avoid it in all other cases. It is an undoubted source of reflex contraction, and may thus precipitate labour in a hopeful case. If properly applied, the plug may be left for a considerable time without interference, and may be expelled with the ovum, but it is a safe rule not to leave it for more than twelve hours. If removed, and the hæmorrhage continues while the os is still contracted, there is no course open to us but to renew the plug, and this may always be done with the less hesitation, as it is well known that the risk of internal hæmorrhage, leading to accumulation in the womb during the period of abortion, is very trifling, and has rarely been observed earlier than the sixth month.

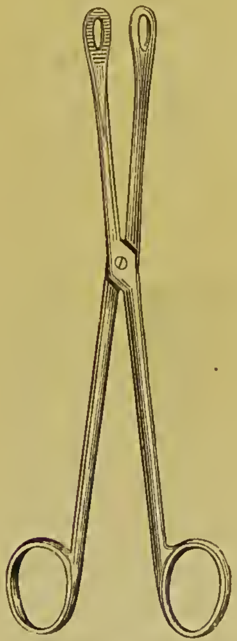
As in the case of other hæmorrhages, astringents are frequently given in abortion, sometimes with good effect. It is, however, in the earlier abortions in which this is most marked, when acetate of lead, gallic acid, and the mineral acids, may often be given with advantage. The more advanced the pregnancy, the less can we rely on ordinary astringents, so that we must then resort to oxytocics, with the view of exciting uterine contractions of such force as may expel the ovum, or any portion of it that may be retained. A simple enema, or one containing turpentine, will often serve as a powerful incentive to uterine action. If the abortion is one of the sixth month, we may sometimes be justified, when the hæmorrhage is alarming, in rupturing the membranes, as in an ordinary case of accidental hæmorrhage towards the end of pregnancy—a mode of treatment which was recommended by Puzos. More probably, even then, we would make choice of plugging, in preference to a mode of procedure which must even further remove any small chance of saving the ovum that might exist.

Management of the Placenta.—It is the Expulsion of the Placenta, however, in regard to which the greatest difficulty is often incurred. If that period of pregnancy has been reached at which this organ is distinct, the main difficulty would seem to arise from the firm anatomical connection which subsists between the uterus on the one hand, and the placenta on the other. If, therefore, the whole ovum is not expelled entire, as is usual in the early weeks, the effect of the uterine contractions will probably be to rupture the membranes, and discharge the embryo or fœtus through the cervix, which has been sufficiently dilated for this purpose. The action then ceases, the os closes, and the placenta is retained; so that here the analogy between abortion and labour at the full time ceases.

This being the state of matters, two courses are open to us—to remove the placenta after forcible dilatation of the os, or to leave the case to nature. Arguments have not been wanting in favour of both modes of procedure, and it is sometimes a matter of no small difficulty to decide which plan we should adopt. All admit that a complete separation and discharge of the placenta and membranes is of the first importance, and it is not to be doubted that the retention of any portion of the placenta or membranes is a condition which, with good reason, gives rise to no little anxiety. Probably the most judicious method of treatment is, in all cases, to remove the retained structure at the time, if this can be easily effected; but if, on the other hand, there is a retained placenta and a rigid os, it is on the whole safer to wait for a time than at once to operate, provided the symptoms are not alarming. When, after an interval of hours or days, as the case may be, hæmorrhage recurs, with pains more or less distinct, indicating further separation of the placenta and renewed uterine efforts, we must carefully observe the symptoms which are being developed, and manage the case accordingly. The hæmorrhage may be so profuse as to require the plug, while we wait for the dilatation of the os. While this process is slowly being effected, we may find that a portion of the placenta occupies the cervix, and can already be reached with the finger. Great caution should here be exercised, and, if the hæmorrhage is not alarming, it may be set down as a rule, that we should abstain from interference until there is some evidence of entire separation of the placenta, or until the os has reached a stage of more advanced dilatation; and even then, should all be going on favourably, it will be better to leave the process to nature, than to interfere, with the view merely of accelerating a process which nature is satisfactorily effecting. If we interfere prematurely, we incur the danger of removing from the os a portion only of the placenta, after which the closure of the os may again occur; and, besides this, the flow of blood may thereby be actually increased, as the portion removed may have served as a natural plug.

Removal of Placenta.—The symptoms which call for more prompt measures are—in addition to profuse and repeated hæmorrhage—fœtid discharges and febrile symptoms, especially if the latter may seem to indicate septicæmia. Then we should act without hesitation, as the risk of allowing septic absorption to go on is greater than that which attends even forcible dilatation of the os, so that the immediate removal of the placenta becomes our first object. With this in view, the finger is to be cautiously passed round the protruding portion, and, if necessary, another finger may be introduced into the os. If we can thus succeed in getting a hold of the placenta upon which we can rely, it may be extracted entire; but a rude or unskilful mode of manipulation may entirely frustrate our efforts by leaving behind a portion of what we wish to remove. It is impossible to lay down rules for the skilful performance of this manœuvre, which can only be taught by experience; but we have no doubt that more reliance is to be placed upon the fingers than upon instruments. Levret recommended the injection of a pretty powerful stream of warm water, by means of a syringe, into the uterus, on the same principle as is adopted for the removal of wax or foreign bodies from the ear; but the danger of intra-uterine injection, which modern practice has revealed, will probably deter most operators from adopting this plan. The placental forceps was devised by the same authority with the object of grasping and removing a retained placenta. Since then many varieties of this instrument, some of them most ingenious, have been constructed. Among others, Dr. Dewees recommended a wire crotchet, which he had used with good effect; and this, variously modified, has been not unfrequently employed since his time. It must be confessed, however, that, whatever ingenuity may be exhibited in the construction of those instruments, the fingers are almost always to be preferred, and, if employed at all, they should only be used as auxiliary to the safer means of ordinary manipulation.

Fig. 145.



Placental Forceps.

In a certain number of cases benefit is derived from the use of ergot, and we need never hesitate to employ it; but we must not count too much upon its action, for the smaller the bulk of the uterine contents, the less is it to be relied upon.

Under ordinary circumstances, abortion is attended with but little risk to the mother, and the cases in which her life is placed in jeopardy are, therefore, relatively rare. Without taking into consideration the numerous instances in which abortion actually takes place, and is never recognised as such, this termination of pregnancy is of such frequent occurrence that the difficulties and dangers above described are only too familiar to the busy practitioner. Dr. Whitehead of Manchester made this a point of special investigation, and found that out of two thousand pregnant women, who had applied to the Manchester Lying-in Hospital, the number of their abortions amounted collectively to one thousand two hundred and twenty-two. Thirty-seven out of every two hundred mothers had aborted before they had reached the age of thirty, and among those of a more advanced age the proportion of abortions was very much higher. It is, in point of fact, a rare thing for women to pass the greater part of the child-bearing epoch in wedlock, without having aborted once, or oftener—which, along with the facts above cited, will suffice to show how enormous must be the loss of fœtal life in the aggregate.

After-Treatment.—The treatment after abortion is a question of considerable importance; but, unfortunately, it is often a difficult matter to persuade a woman of the necessity which exists for the exercise of ordinary prudence and care. Under favourable circumstances, all that may be necessary is confinement to bed for a few days, and avoidance of fatigue and exertion for some time thereafter; but, in other cases, a more strict regimen may be necessary. Should retained fragments of placenta give rise again to hæmorrhage, the patient must not be permitted to rise until all trace of this has ceased;[1] and if her general health has materially suffered, a course of chalybeate tonics, change of air, tepid sea-baths, and the like, must be resorted to, with a view of restoring the health. The great danger accruing from neglect of these precautions is not so much to be evinced in immediate effect as in the more remote results; and we are convinced, from long experience, that no more fruitful source of menstrual disorder or of chronic uterine disease exists, than what arises from a want of due precaution at this critical period of a woman's existence.

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[1] A peculiar formation has been described by Scanzoni, Braun, and others, under the name of *Placental Polypus.* In these cases, some portion of the placenta remains in permanent connection with the uterine wall by a pedicle, through which its vitality is maintained. It may be removed, by the fingers or by the écraseur, after dilatation of the os.

It is well to bear in mind that the two chief peculiarities of abortion, as distinguished from ordinary labour at term, are hæmorrhage *before* delivery and a greater tendency to retention of the placenta.

Premature Labour.—But little of a special nature remains to be said of Premature Labour, which occurs after the twenty-eighth week of gestation—at a period, therefore, at which the child is held to be "viable." A vulgar idea very generally prevails, that children born at the eighth month are reared with more difficulty than those which are prematurely expelled at the seventh; but careful observation has clearly shown, what reason and analogy would have led us to conclude, that the further removed from the natural term of pregnancy is the period of delivery, the less chance is there of rearing the child. Many of the causes which have been enumerated as inducing abortion may also operate similarly at this more advanced period of pregnancy, but there are undoubtedly other special causes which may also be mentioned. The most important of these latter is over-distension of the womb, from whatever cause this may arise. Plural pregnancy, dropsy of the amnion, and hydrorrhœa, are all causes of this nature; and the immediate result of their operation is that the uterus attains, at a period much earlier than is usual or normal, that degree of distension which is characteristic of completed gestation. The symptoms and treatment of premature labour differ in no essential particular from what obtains at the full term. If the dilatation of the os is somewhat tardy, a commensurate mechanical advantage is gained in the ease with which the fœtus passes through the parturient canal. There is, however, without doubt, a greater tendency to retention of the placenta, although in a much less degree than in the course of the abortion period; and, the nearer the delivery is to the natural term of gestation, the more strictly identical are the symptoms with those of mature birth.

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